MACHINE DESIGN

PARTS • MATERIALS • METHODS • FINISHES

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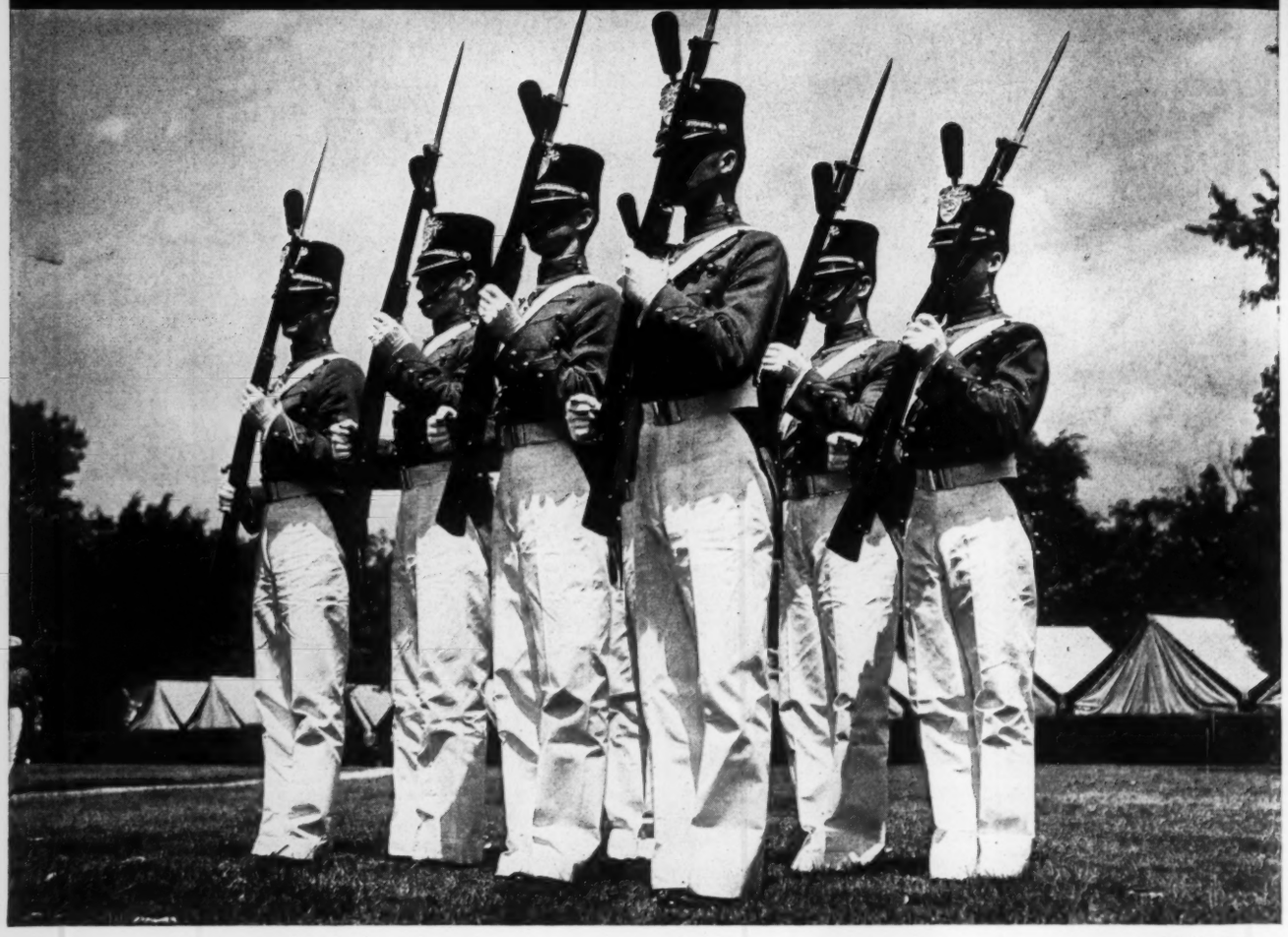
ONE WILL REACH THE HIGHEST RANK



EWING GALLOWAY

. . . for one has all the qualities of a leader

Ball bearings, too, look very much alike. Yet actually they differ in respects that affect their future performance and that of the machines they will serve.

New Departures have *all* of the important attributes that make them leaders . . . superior design, forged alloy steels for great endurance—precision dimension—and equally important: *creative engineering* to apply the bearings effectively and economically.

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Please do not forget that, whatever your bearing problems, New Departure engineers are always ready to help you save and improve.

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2716

Nothing Rolls Like a Ball

NEW DEPARTURE

WORLD'S NO.1 BALL BEARING

This Motor-Drive helped shatter *Sheet-Rolling* records

The originators of the automatic roller and catcher tables were after *more than power* when they came to the motor builders for a motor-drive. They asked for something new,—a squirrel-cage motor capable of reversing forty times a minute. While most designers placed it in the can't-be-done class, Reliance, with some splendid help from sheet-mill engineers and equipment builders, developed the first successful alternating-current drive.

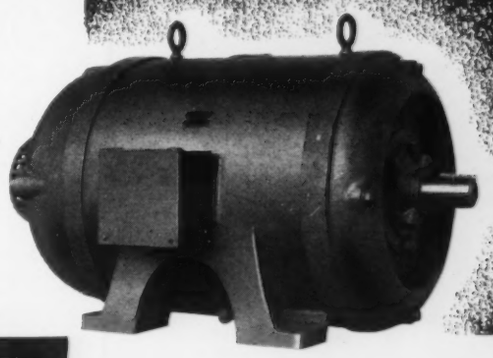
This is a sample of how Reliance Engineers are finding ways to make motor-drive a bigger factor in production. It emphasizes again the importance of tackling an application job with the question, "What can we get the motor to do besides supply power?" Experienced men in our branch offices are prepared to help you find the answer promptly.

RELIANCE ELECTRIC & ENGINEERING CO.
1088 Ivanhoe Road Cleveland, Ohio

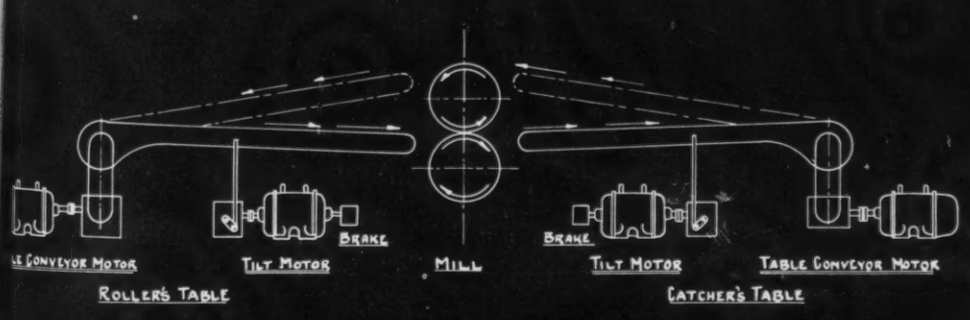
Branches: Birmingham, Boston, Buffalo, Chicago, Cincinnati, Detroit, Greenville (S. C.), New York, Philadelphia, Pittsburgh, Syracuse (N. Y.).
Representatives in other principal cities.

The Wean Automatic Roller and Catcher Tables on this sheet mill perform what was formerly a back-breaking task. Four motors are used: two for table conveyors, two for the tilting devices.

A single control station governs the entire drive. With it the sheets to be rolled are permitted to enter the roller's table and the finished sheets allowed to leave the catcher's table. When on "automatic" the tables tilt and reverse automatically. Sheets pass through the mill onto the catcher's table and then back over the top roll to the roller's table for re-rolling. The process is continuous with no manual effort.



↑ A-c. Squirrel-cage Reliance Motor for automatic rolling and catching tables . . . Motors have special torque characteristics to give rapid reversals. Low-inertia rotors keep reversing losses at a minimum. There's full protection against dirt, oil and moisture . . . Many of these motors have passed 25,000,000 reversals and are still going strong. Because of their good records, Reliance Motors are well in the lead in this field. They have been installed in every country having a modern sheet mill.



RELIANCE A-C D-C MOTORS

Topics

Handling of blueprints and their corresponding specifications has been greatly simplified by a machinery manufacturing organization, the Dexter Folder Co., by duplicating on the reverse or white side of blueprints. Formerly, specifications were run on a printed form and tacked on a fiber board. On the reverse side of the board was attached the accompanying blueprint. To prevent smudge from mechanics' greasy hands, varnish was applied to both blueprint and specification. The new method involves use of a negative master, printed with the regular specification form, which is filled in. Copy is run on the reverse side of as many blueprints as needed, and each print is inserted in a cellophane envelope and immediately handed to a mechanic. Both surfaces of the print are protected by the envelope and necessity for varnishing is eliminated.

♦

Butt of countless derisive anecdotes, well-pierced target of many political attacks, the Federal Works Progress Administration nonetheless merits appreciation in one respect from machine builders. In the first three years of its existence through June, 1938, it purchased $27,303,000 worth of machinery and mechanical equipment. Of this sum, $14,192,000 went for electrical machinery, apparatus, supplies; $12,185,000 for miscellaneous equipment; $926,000 for paving machinery. In addition, an estimated $130,000,000 was paid for rentals and services of various kinds of machinery and equipment, which when replaced will represent a considerable market.

♦

British speed supremacy with automobiles became front-page news during the recent friendly—albeit serious—competition on the Bonneville salt flats between Englishmen Eyston and Cobb. Now comes word of another speed crown captured in the "tight little isle." Last July the London & North Eastern Railway's streamlined express, *Coronation,* sped 125 miles per hour. A record for steam locomotives was not claimed immediately, however, because it was believed a German train had exceeded that mark on a test run between Berlin and Hamburg. Subsequent checking of instruments proved the British locomotive faster. But small room for quibbling or boasting was left. German train's speed: 200.4 kilometers or 124.5 miles per hour.

♦

Another new plastics development is a printing material which is fused on a hard wood laminated base. The surface is said to be smoother than any other known printing material, excellent for printing tints and finishings, easy to engrave. The manufacturer is preparing to manufacture wood type with the plastic face.

♦

Note on nomenclature: American Gear Manufacturers' association, at its twenty-first semiannual meeting Oct. 10-12, passed a recommendation to the effect that gear motors, speed reducers, and other gear transmission units will in the future be called "enclosed gear drives." At the same Gear Manufacturers' meeting, incidentally, the importance now attached to industrial relations was strongly emphasized. Attention given the subject, particularly in informal discussions, almost equalled that directed toward technical matters.

♦

A new process for electroplating with copper cuts former plating time to less than one-fourth that required by customary alkaline methods, it is claimed. A copper coating .034-inch thick can be deposited in 2½ hours at 125 amperes per square foot; .0005-inch laid down in only 5.3 minutes at 50 amperes per square foot. The new method is already in production use by companies making musical instruments. A copper shell is built up to the required thickness, then stripped off, producing a horn or cone-shaped piece. Saving in comparison with cost of conventional spinning is said to be considerable.

♦

Beryllium cost $5000 per pound in 1923, when no useful application of it was known. Market price today is about $23 per pound. In the interim, beryllium-copper alloys were developed, one of the uses of which, besides machine parts, is as resistance welding electrodes. Dr. R. H. Harrington, General Electric Research Laboratory, described some characteristics of these electrodes at the annual

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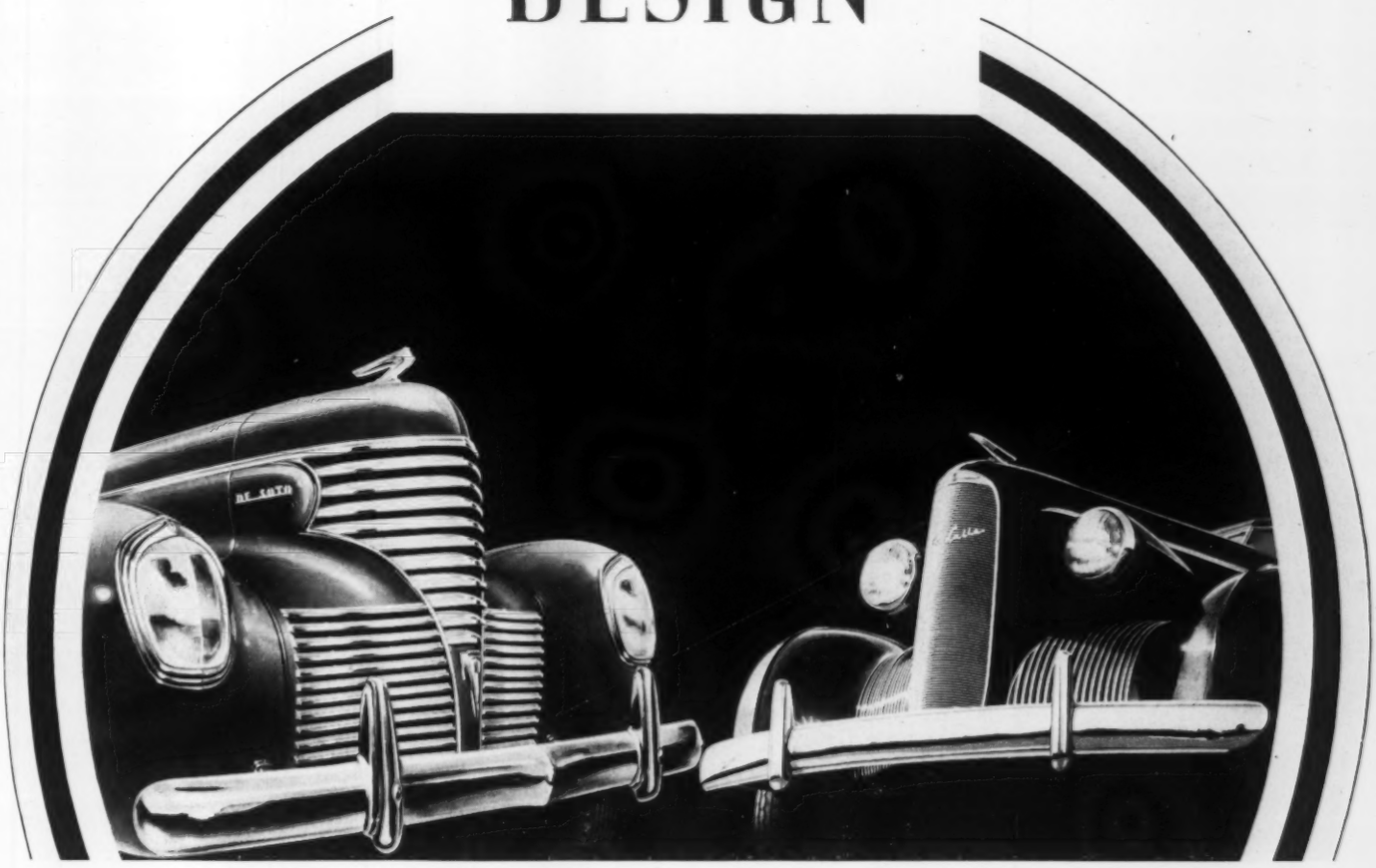
MACHINE DESIGN



Lifting the Curtain on Next Year's Cars

By Austin M. Wolf

Consulting Automotive Engineer

SAFETY accounts for the greatest number of individual improvements in 1939 cars. Highlights are speedometer signals calling attention to excessive speed, easier vision for drivers, lower centers of gravity, more stable steering, and more accessible controls.

Th speedometer used on all Chrysler products, shown in *Fig.* 1, provides a Lucite button in rotating disk to which the pointer is attached. Back of the disk is a transparent window in three colors. The button upon rotation will show green up to 30 miles per hour, yellow between 30 and 50 and red thereabove.

On the trunk lid of the Buick is an emblem which serves also as a flashing directional signal. This is operated by a small flip-switch on the gear shift lever beneath the steering wheel, *Fig.* 2. A pilot light at the left indicates when the light is flashing. When about to turn to the right, the operator moves the switch down

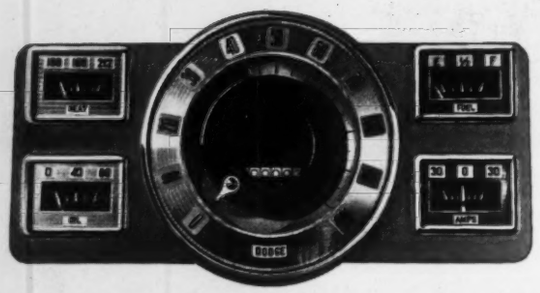


Fig. 1—Rotating Lucite button on Chrysler speedometers shows green up to 30 miles per hour, yellow between 30 and 50, red after 50

and the right side of the signal lamp automatically indicates. When turning the wheel back to straightforward position, it is instinctive to move the switch back to its neutral position. To signal a left turn, the switch is flipped up or in the direction of the steering wheel at the switch side.

Windshield pillars have been considerably lessened in size, reducing the area of the "blind spot." With greater width and height of the windshield, the glass area has been increased in a popular line 32 per cent over last year. The windshield corner radii and those in the various windows are smaller. Deeper dropped frames place the body and passengers lower, thus reducing the center of gravity.

Greater accuracy in steering is obtained in the construction shown in *Fig.* 3 and used by Cadillac, Pontiac and Oldsmobile. An idler lever at the right provides a symmetrical geometric duplication of the steering gear pitman arm and the cross drag link between the two is provided with ball sockets to which the individual wheel tie rods are secured. In rearranging the geometry of the parallel link individual front suspension of the Buick, the front wheels camber at an increasing rate when making a turn, giving greater inherent stability through a banking effect. To save unsprung weight, the lower suspension links in the Cadillac, Pontiac and Oldsmobile are made of stampings instead of forgings. The bosses are extruded to furnish sufficient stock for the threaded bearings at each end except in the case of Cadillac where a plain hole is provided for the rubber bushing on the frame support shaft.

Controls are made more accessible, to prevent confusion at a critical moment. The gear shift lever under the steering wheel has gained popularity because of this ease of access. Lighting switches are increasingly being placed at the left of the instrument group and away from the other control buttons. Chevrolet provides a windshield wiper control knob of streamline shape which affords a handle for easy manipulation and immediately indicates the "off" position. Buick provides a combination ignition and steering gear lock, the new feature of which is that the ignition portion is located at the top of the unit, avoiding the chance of the operator's striking his knee on the lock or accidentally shutting off the ignition by brushing against the lever.

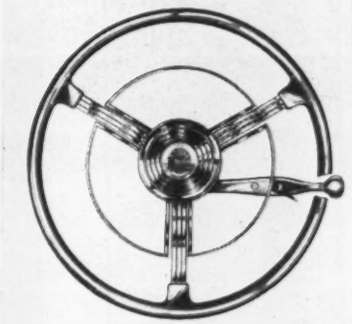


Fig. 2—Small flip-switch on Buick gear shift lever is moved by operator to indicate on trunk lid the direction of turn

Styling, of course, is conspicuous. Louvre openings

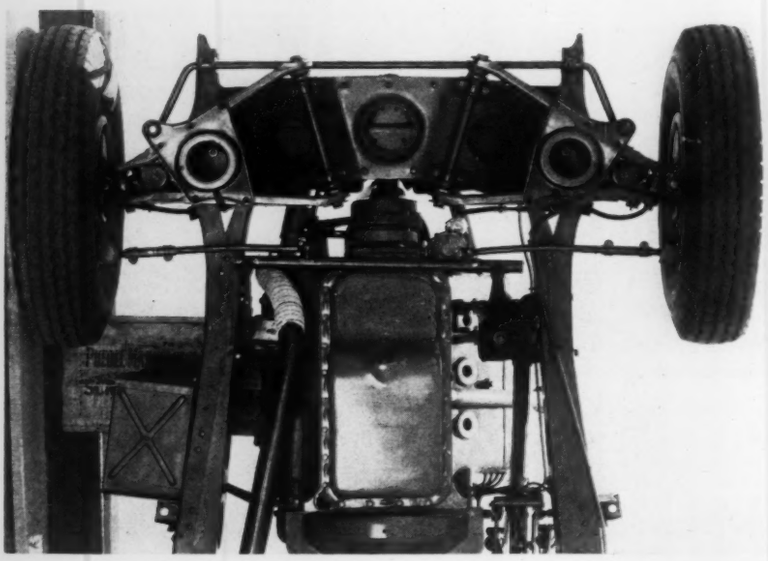


Fig. 3—Front wheels camber at an increasing rate when making a turn because of the construction used by Cadillac, Pontiac, Oldsmobile

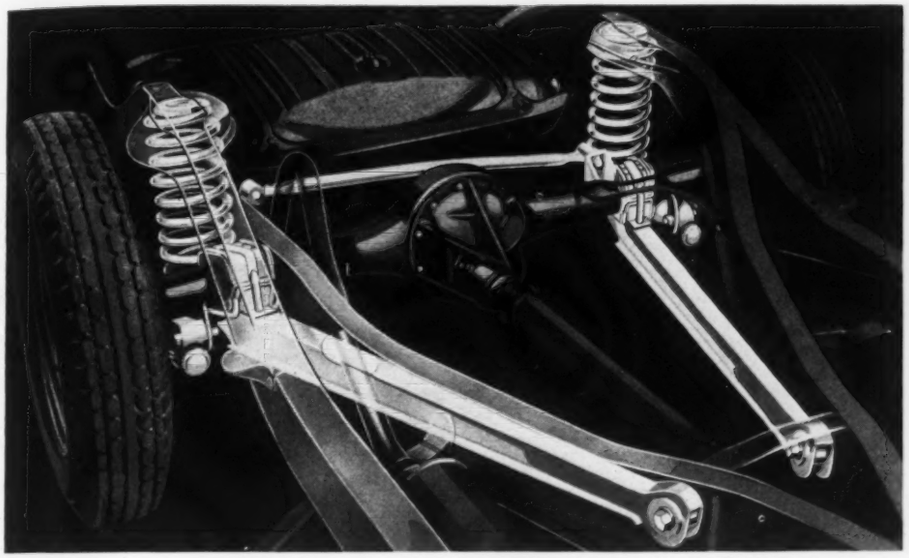


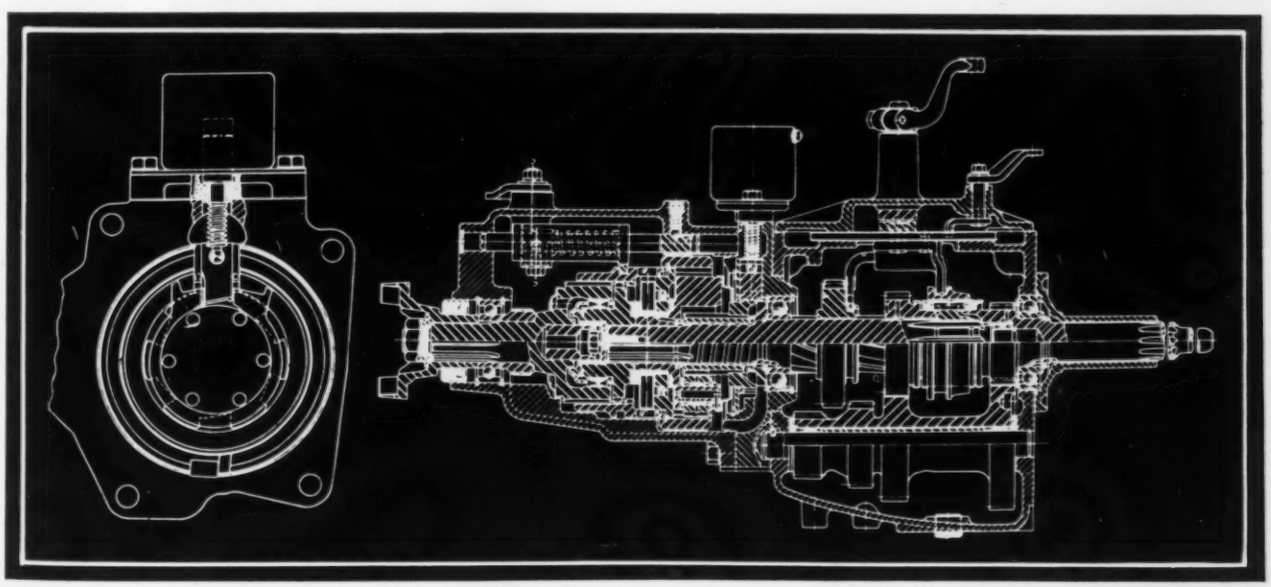
Fig. 5—Coil springs at the rear have been adopted by Oldsmobile. Movement of the axle transversely is prevented by a tubular crosslink running from frame to axle

are placed low at the front, or there is a narrow center louvre in combination with one in each fender apron. The merging of fenders and hood is best exemplified in the new Buicks. Lincoln-Zephyr provides a skirt on the bottom of the doors which covers the running board and keeps it clean.

For smooth exteriors, all General Motors cars except Chevrolet and Pontiac Quality 6 have eliminated all the exterior door hinges except the front door bottom hinge. Many cars are without running boards, although they can be furnished if so desired. Usually a stainless steel trim molding ornaments the lower edge of the body when running boards are not used. Among the various cars built by the Chrysler organization, all the bodies except Plymouth have a streamlined tail in place of the bulging trunk. General Motors bodies continue the side panels back into the trunk to emphasize length and lowness. A sharp crease below the windows makes them and the top appear distinct from the lower portion of the body.

Economical operation is the result of weight reduction and better fuel mileage through improved carburetion and high engine compression ratios. Another factor is the increasing use of the overdrive which now is standard or optional on Studebaker, Chrysler, DeSoto, Nash, Graham, Hupmobile and Packard. The improved overdrive enables the operator to return to direct drive at any time by the instinctive action of stepping on the accelerator pedal beyond the wide open position. In the accelerator linkage a switch is provided which energizes a two-coil solenoid when the accelerator pedal is fully depressed. The forward end of the sun gear of the planetary gear is carried in a

Fig. 4—Improved overdrive in several cars, including the Studebaker shown here, enables the operator to return to direct drive at any time



notched circular member and a pawl engages one of these notches to hold the sun gear stationary for overdrive. The more powerful solenoid coil withdraws the pawl when energized, freeing the planetary system and permitting the drive to be taken up by the roller clutch for direct drive. To relieve the load on the pawl for easy withdrawal, the ignition circuit is broken for two or three explosions and the momentary torque reversal facilitates this action. As soon as the solenoid plunger reaches the outer end of its stroke, the main solenoid circuit automatically opens, leaving the small or holding-coil circuit on and ignition is reestablished. The cutting-in speed for the overdrive varies between 25 and 30 miles per hour as compared to the previous 35 to 40. Studebaker transmission and overdrive are shown in *Fig.* 4.

The "Superfinish" method developed by the Chrysler Corp. is used on such engine parts as the crankshaft main and pin bearings, camshaft bearings and contours, valve tappet heads and stems, cylinder bores, pistons, piston pins and flywheel face. Ferrous oxide-surfaced piston rings are used by most of the manufacturers and in addition Cadillac, Chrysler, and Packard are using an alloy primarily developed for diesel and aircraft rings. The increasing use of rubber bushings throughout the chassis has decreased the number of points requiring lubrication.

Insurance against theft has been increased. The Hudson cars with the forwardly hinged alligator hood top are provided with a lock operated from the inside of the car, preventing tampering with the engine or ignition system. The ventipane window of the General Motors cars is provided with a sliding latch bolt which seats against the vertical window-guide and prevents "jimmying." The use of the basic body shell on a number of different cars by the same organization promotes manufacturing economy. Similar component chassis parts such as transmissions, rear axles and propeller shafts are interchangeable.

Bodies are roomier and a new type borrowed from Europe is the "sunshine top" offered by General Motors on various models. It is of all-steel construction and is pushed back under the rear part of the regular top to obtain an opening 24 inches long by 40 inches wide. A cam arrangement forces the movable section upward sufficiently to make it flush with the surrounding top of the car when closed.

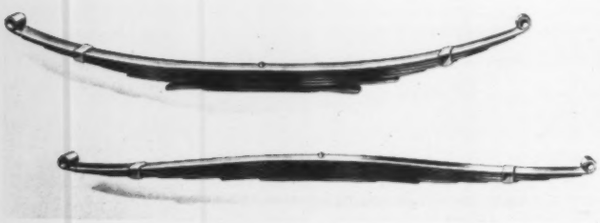


Fig. 6—A three-leaf auxiliary spring located below the main spring provides a variable rate rear spring in Pontiac which becomes stiffer with greater load

Fig. 7—Less pedal effort is the purpose of clutch design this year. Instead of the 18 integral inturned fingers, the Buick 40 clutch spring unit has a corrugated face

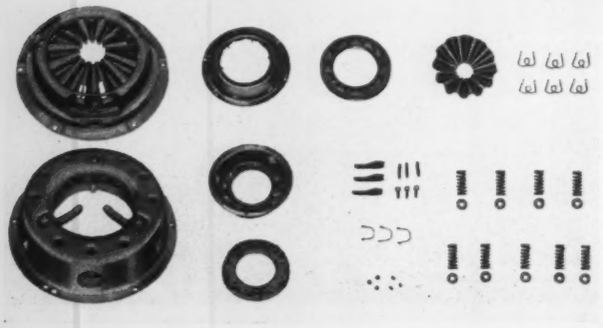


Fig. 8—A new design is the Chevrolet steering gear pitman arm which transmits motion to the two transverse drag links, one to each wheel spindle arm

Suspension springs are softer and Oldsmobile has adopted coil springs at the rear as shown in *Fig.* 5. Movement of the axle transversely is prevented by a tubular crosslink running from the frame to the axle, the connections at each end being rubber-bushed. To prevent fore and aft movement, a torque arm of channel section extends diagonally forward to a rubber-bushed anchorage in the frame X-member. The arms pass under the axle and extend back to form seats for the coil springs. Connection between the axle and the arms is through rubber, thus enabling the axle, with the aid of the front arm mountings, to assume various angular positions under the car. Driving and braking forces are through the arms to the frame, and noise and vibration from the axle are not transmitted. Pontiac provides a variable rate rear spring shown in *Fig.* 6, in which a three-leaf auxiliary spring

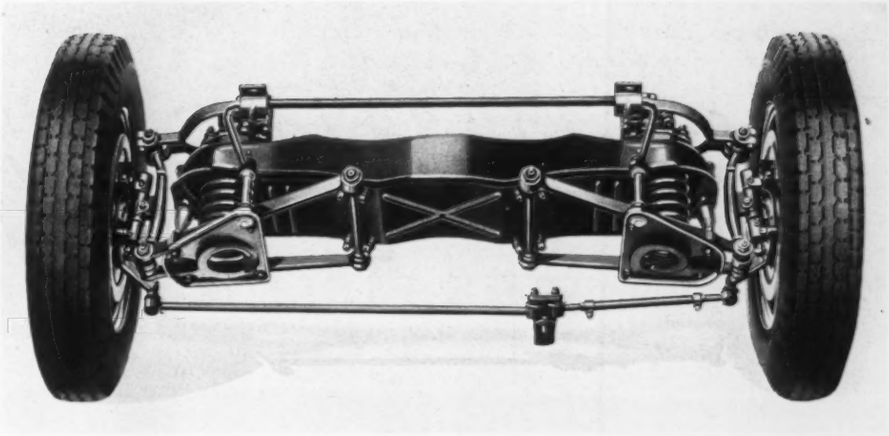


Fig. 9—Chief difference between the parallel link type front suspension finally adopted by Chevrolet in place of the Dubonnet is that the axes of the link anchorage on the frame are parallel with each other

is located below the main spring. As the load on the spring increases it becomes stiffer and a more constant ride is obtained whether a partial or full load is in the car.

Over-center springs are used to ease the necessary pressure on the clutch pedal and a similar arrangement is used to facilitate gear engagement. Steering column gear shifting is either standard or optional on the majority of cars and in most instances it is of the straight mechanical type. In these arrangements the usual method is to provide a tube in line with the steering column with a lever at the bottom of the tube and a rod connection to a shifting lever on the outside of the transmission. Rocking the shift lever through neutral causes selection of the proper shift rail in the transmission and this is accomplished in most instances by a flexible cable. Chevrolet provides an optional shift in which the piston in a vacuum cylinder assists the manual operation. A reactionary lever system enables the operator to "feel" the shifting action.

Clutches are designed for less pedal effort and to assure freedom from spinning in shifting gears. The Chevrolet diaphragm clutch described in MACHINE DESIGN for November 1937, is now being used in the Pontiacs. In place of the 18 integral inturned fingers, the Buick 40 clutch spring unit has a corrugated face as shown in *Fig.* 7. A number of clutch-driven plates consist of individual spring segments riveted to the hub plate. The polar moment of inertia is reduced by the minimum amount of metal between the friction disks. These are riveted to the spring segments on alternate waves. Fluid flywheels have finally made their appearance in the Chrysler Custom Imperial as standard equipment. The Yellow Coach Co. in conjunction with the Spicer Mfg. Co. has developed a Ljungstrom type of hydraulic converter for bus use which is somewhat similar to the fluid flywheel except for three stationary sets of reactance blades in the hydraulic circuit which enable the device to increase the torque output. A small radiator is used to cool a portion of the fluid which is by-passed from the main circuit.

It will be seen from the above developments in automotive transmissions that the stereotyped gear box and friction clutch are still very much with us. The ease of their operation has been improved considerably. Hydraulic devices are just beginning to show some signs of commercial use and they will no doubt foster the adoption of mechanical systems which are already tried and proved. But the infinitely variable transmission is still very far off insofar as reliability and long life are concerned. This is also true regarding a fully automatic transmission.

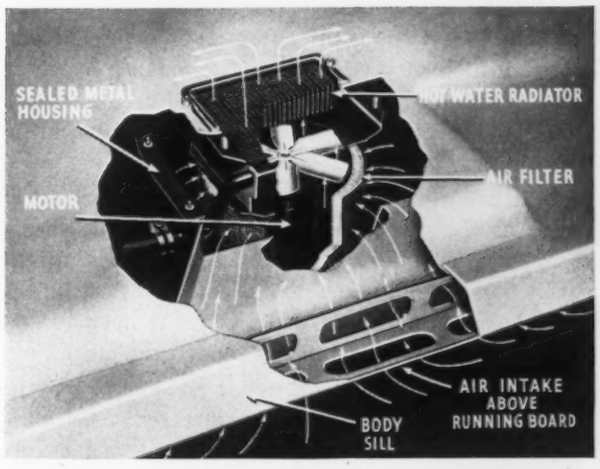


Fig. 10—Studebaker air conditioning system consists of a sealed metal housing beneath the floor, containing air filter, hot water core, fan and motor

Steering gear ratios have been slightly reduced for easier handling. Many are mounted in rubber in the frame for shock absorption. A new design, *Fig.* 8, is the Chevrolet Master DeLuxe steering gear pitman arm which transmits motion to the two transverse drag links, one to each wheel spindle arm, by two customary steering ball studs secured in a plate above it. Two cylindrical studs riveted to the plate and in line with the pitman arm pass through rubber bushings in the latter. Excessive relative movement between the arm and the plate is prevented by the projecting lugs that are easily seen on the arm forging. The overall

(*Concluded on Page* 67)

Scanning THE FIELD FOR Ideas

UNIFORM and rapid heating of the plastic material in the cylinder of an injection molding machine is of great importance in the successful production of plastic parts. The manner in which this problem has been met by the Reed-Prentice Corp. is shown by the photograph and diagram appearing herewith as *Fig.* 1.

As is indicated by the diagram, the cylinder proper serves as the core of an induction coil. It is so designed as to induce maximum heating effect in the steel. Since the plastic material is forced through the seven holes shown in the end view, it is obvious that even heat must be maintained in the material.

With this type of cylinder it is possible to get the thermocouple very close to the material, thus eliminating much of the lag between material temperature and temperature at the point of control. Another advantage is that a great amount of heat can safely be generated in the necessarily rather confined space.

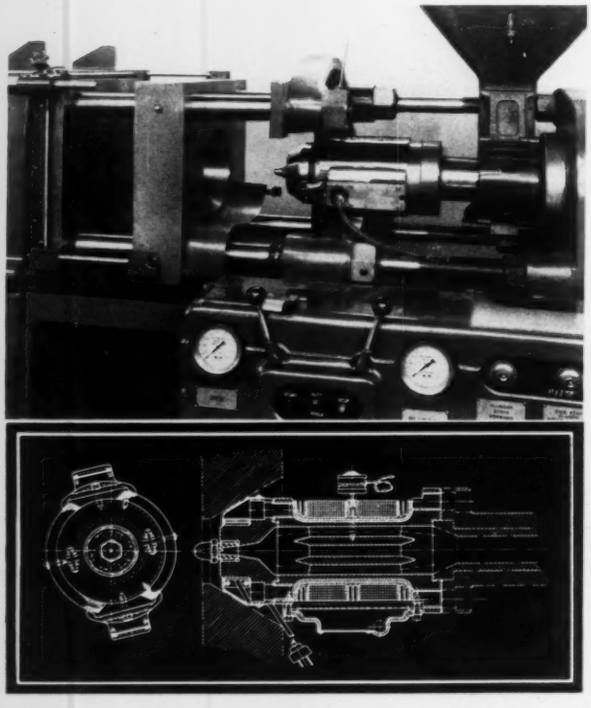


Fig. 1—Details of new system whereby cylinder of plastic molding machine is heated by induction

The two coils of this induction heated cylinder ordinarily are hooked up in series through automatic pyrometer control which is designed to maintain proper operating temperature when the machine is running at its maximum capacity. When starting "cold" however, the coils can be hooked up in parallel —thereby quadrupling the heating effect. When a point within six degrees of the temperature to which the control is set, is reached, the coils are switched automatically to "series," which as previously mentioned is the operating hook-up.

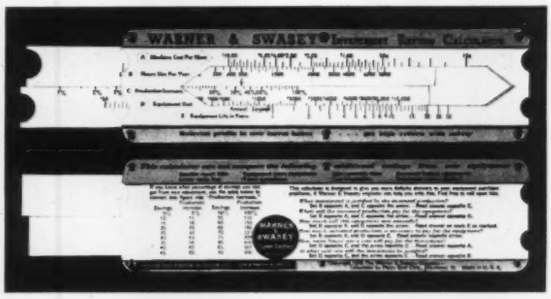


Fig. 2—Special slide rule evaluates economies possible through installation of new equipment

Should the temperature drop to six degrees below the pyrometer setting, during operation of the machine, the coils automatically resume their parallel arrangement and the temperature is brought back very quickly to the proper level. Average time required, at normal room temperature, to bring the machine up to operating temperature of 400 degrees Fahr. with this induction heating system, is five minutes.

Another point worthy of note in the design of this plastic molding machine, is its instrumentation.

Rule Solves Equipment Problems

WHETHER an investment in new equipment is justified generally depends upon such factors as (1) its cost, (2) the increased production possible with it, (3) the number of hours use per year, (4)

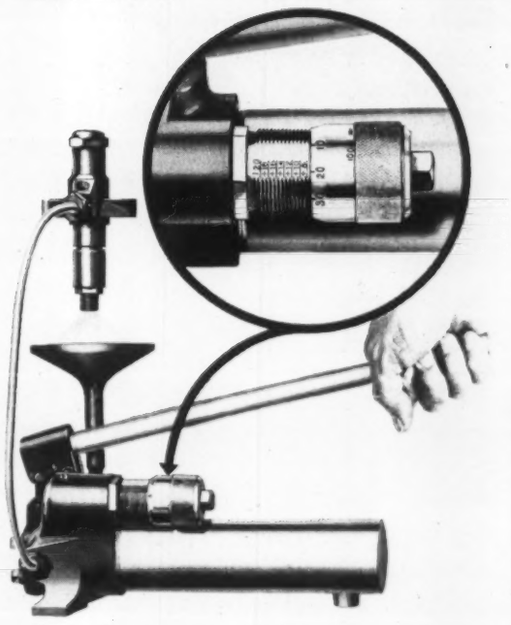


Fig. 3—Adjustable pressure oil pumping device simplifies testing of diesel engine nozzles

the machine cost per hour, and (5) its useful life.

Equipped with five scales, three of the movable, a new slide rule developed by a sales engineer of The Warner & Swasey Co., permits rapid calculation of any one of the foregoing factors when the others are known or can be approximated. Thus it affords a speedy answer to the question of profit possibilities of investment in the new piece of equipment.

Suppose the purchase of a new turret lathe costing $5000 is being considered. There is enough work to keep the new machine operating 2600 hours per year. Machine operating cost is $1.50 per hour and the new machine will increase production 33 1/3 per cent. How long will it take the machine to pay for itself, and how much will it save annually? Setting up the known factors on the slide rule (as in the illustration, *Fig.* 2) it is a matter of seconds to find that the new turret lathe will pay for itself in less than four years, earning almost $1300 annually.

Diesel Nozzles Quickly Tested

DEVELOPED in the Fuel Research laboratories of the Waukesha Motor Co., the apparatus depicted by *Fig.* 3, and on which patent is pending, permits accurate test and adjustment of any standard make of diesel injection nozzle. The hydraulic pump is operated by a hand lever and fuel oil is contained in a horizontal cylinder below the pump, this reservoir holding approximately one pint. From it the fuel oil —same as used in the engine—is drawn through a filter into the pump. It then is forced through the short length of high pressure injection tubing and is discharged from the nozzle being tested, into the funnel which returns it to the reservoir. Nature and pattern of the spray tells the story of the condition of the nozzle.

A balanced by-pass valve connects the delivery passages drilled in the malleable iron pump head, and a return port leads to the reservoir. By controlling spring tension of this by-pass valve, pressure in the nozzle line can be adjusted with accuracy to any required nozzle setting. This is accomplished by means of the knurled micrometer head shown by the enlarged view in the cut. One complete revolution of this head changes the discharge pressure by 100 pounds. The head is graduated to 10-pound intervals but the spaces between them are wide enough so that 5-pound increments readily can be estimated.

Spot Welder Has Rolling Switch

ULTRA-SPEED spot welding is now being accomplished on machines built by The Federal Machine & Welder Co., by means of the automatic system of control depicted by *Fig.* 4.

The new machine embodies a fixture into which parts to be welded are accurately located and firmly held. This fixture acts as one side of the secondary circuit of the welding transformer. The welding electrodes are usually in the upper part of the machine, as indicated in the view at left of cut.

The secondary circuit from each individual electrode connects to a segmented bar. This appears in the enlarged view at right in the cut. A contact roll, also visible in latter view, acts as a switch by rolling across the segments, thus connecting each one in turn to the other side of the secondary of the welding transformer, which completes the circuit.

The contact roll is propelled by a screw driven by a fractional horsepower motor through change gears. The roll can be made to effect from five to twenty spots per second—depending on nature of work. After the roll has made one sequence of welds, or has

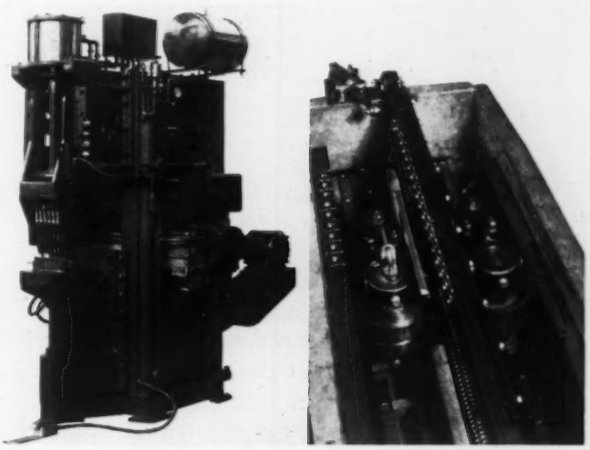


Fig. 4—Rapid succession of clean, strong spot welds is made possible by motor-driven rolling switch

Fig. 5—Two-power magnifier with 15-watt lamp enables workman exactly to follow layout lines

traveled full length of the segment bar, it is stopped by a limit switch which cuts off the motor and sets a magnetic brake at the end of the screw. The unit then makes another sequence of welds by traveling in the opposite direction.

Timing of each individual weld is accomplished by a switch wired in series with a tube-type contactor and mounted on the contact roll assembly, which makes and breaks in an adjustable notched bar. Each notch corresponds to one welding electrode.

The lower die, or the upper electrodes as a unit, can be lowered or raised by pneumatic or hydraulic means which must exert pressure sufficient to overcome the combined pressure of all of the spring-loaded electrodes—of which there may be from ten to several hundred. Regardless of their number, the transformer capacity is small because only one electrode welds at a time Panels are held in perfect shape by the electrodes acting as hold-down clamps.

Illuminated Magnification

SHOWN in *Fig.* 5 is an interesting optical attachment for use in connection with production and with tool room machinery. This device, which is a development of Continental Machine Specialties Inc., is illustrated in connection with one of their combination sawing and filing machines of continuous band type. It can also be used on other types of machines.

The attachment consists of a two-power magnifying glass, 2 by 3¾ inches, into the frame of which is incorporated a 15-watt lamp which plugs into any standard electrical socket. This assembly is mounted on a ball joint which in turn is held by adjustable right angle posts mounted on a clamp base.

The magnifier is large enough to permit vision with both eyes without strain, and by the effect of doubling the size of the layout line it permits working exactly to the line with the finest saw blades and files. Illumination is even over the entire field of view. The device is easily detached from the machine and so can also be used effectively on the layout and inspection benches.

Press Frame Is of Pearlitic Iron

DESIGNED to draw the entire top of an automobile from a flat sheet of steel, in a single quick, smooth stroke, the Bliss press shown in *Fig.* 6 has an overall height of 34 feet.

The mechanism of this huge machine is what is known as double action toggle type and as compared to some earlier designs it will be noted that this mechanism has been housed in so as to give the exterior of the machine a desirable appearance of smoothness as well as effective protection.

From the point of view of materials, this press also has some points of interest. To insure more than ordinarily high tensile and compressive strengths, hardness of surfaces and maximum shock absorbing or vibration damping characteristics, the frame members and other main parts are of the latest high test alloy pearlitic irons.

To add still further to the tensile strength of the side frames, high tensile steel tie rods are run through them so as to lock them together with the head and base members. These tie rods are shrunk into place at predetermined overstress.

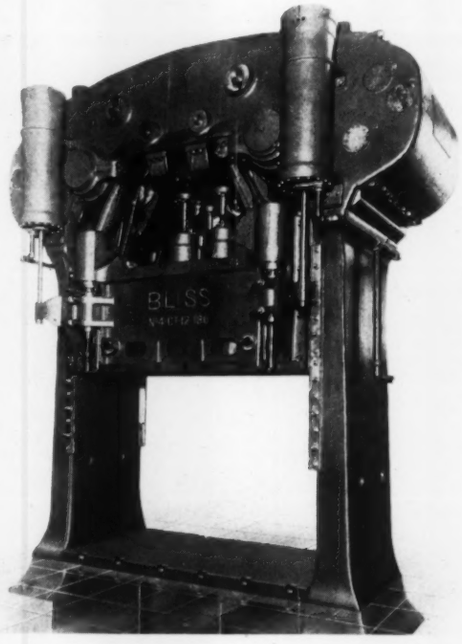


Fig. 6—High tensile alloy iron frame of this press is further strengthened by steel tie rods

Stamped and Pressed Metal Parts In Modern Design

Part III

By Guy Hubbard

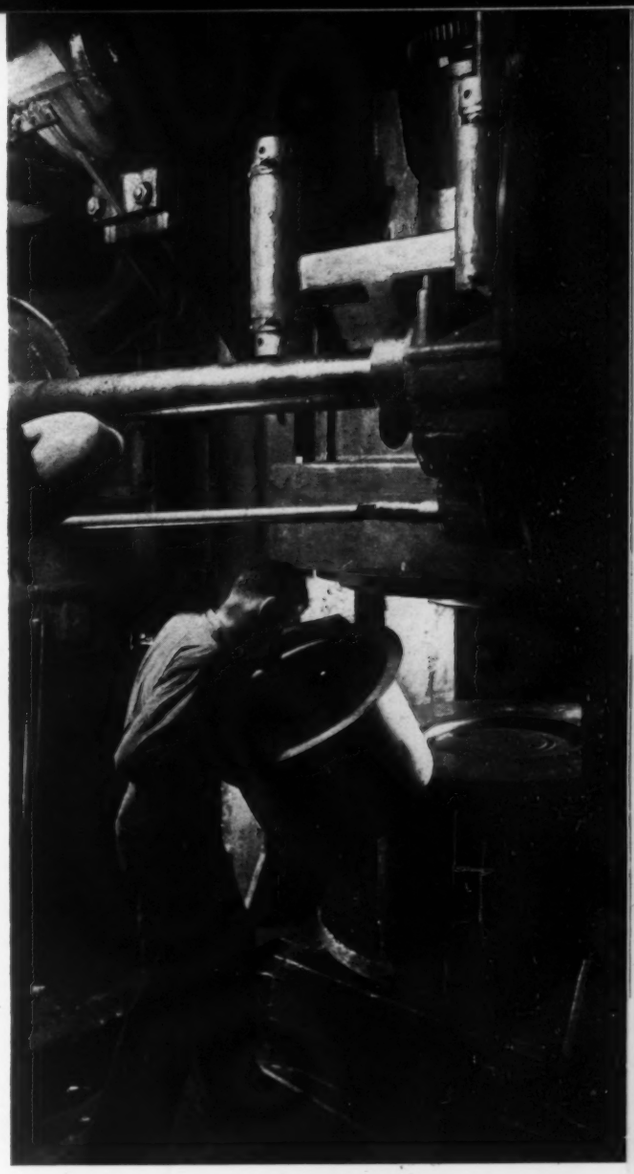


Fig. 1—This washing machine tub, which is 16¼ inches deep, is formed at a single draw in a 1000-ton press, from a flat disk of deep drawing steel stock

ATTENTION already has been called in this series of articles, to the great importance in the development of the stampings industry of recent improvements of sheets and strip stock. What the manufacturers of these materials have done in the way of bringing out wider sheets; longer strips in coils; materials of close and consistent accuracy and high finish; and stock with increased deep-drawing ability certainly deserves all the emphasis that we can give it in a survey of this kind. Many of the achievements which we are covering would have been commercially impossible ten years ago for the simple reason that the required materials were not at that time available.

Take for instance this extremely important matter of deep drawing. In our first article we made the following statement: "To keep pace with the automotive industry, deep drawing stock has been developed which is of benefit to manufacturers of many other products. For instance, tubs for washing machines—which used to require three operations for drawing to full depth—are now produced successfully by a single draw."

Through the courtesy of the Carnegie-Illinois Steel Corp., we are now able to drive home this point by means of an action photograph, *Fig.* 1. This shows the operator of a 1000-ton press removing from the die a tub which only a few seconds before was a flat disk of sheet steel. The single draw is to a depth of 16¼ inches and the average is 99 perfect draws per 100 blanks. Note absence of wrinkles, "ears" and other evidences of non-uniformity which would be fatal to these parts—which subsequently are finished by vitreous enameling.

Spectacular and highly important though they are, present day achievements in deep drawing should not be allowed to overshadow the less spectacular but equally important developments in other fields of

Fig. 2—Punching stator laminations for large generator (Photo courtesy United States Steel Corp.)

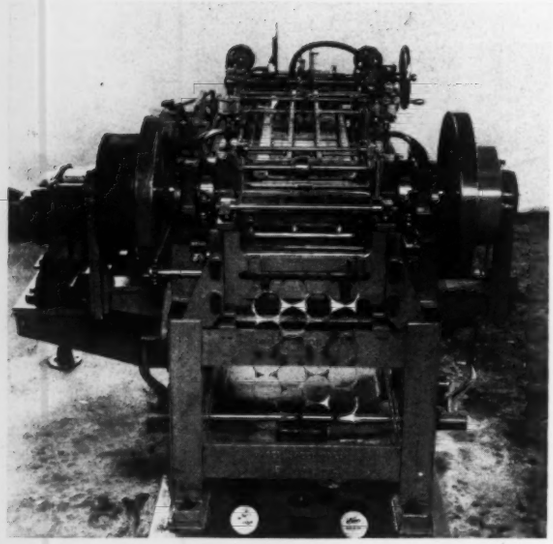
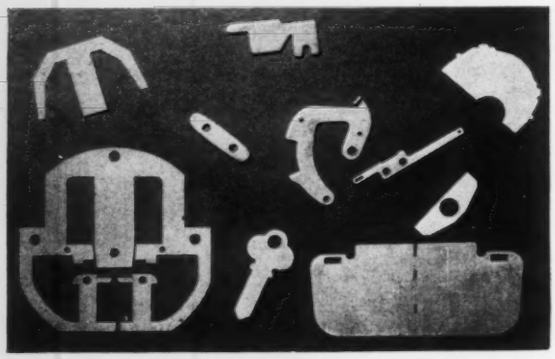


Fig. 3—Above—Rear view of high speed punch press of continuous feed oscillating die type

Fig. 4—Below—Typical examples of stamped metal parts made economically on above machine



stamping and forming. Consider for instance the influence on the design of electrical machinery of the so-called "electrical sheets," which are now widely used for the stamped laminations for armatures, stators, etc.

A clear idea of how such parts are designed and manufactured is given by *Fig.* 2 which shows an operator punching out laminations for the stator of a large generator —the material being sheets of silicon steel. When solid bodies must be built up by "stacking" sheet parts such as these, it is extremely important that the laminations be free from burrs and exactly to gage, which calls for smart work on the part of die designers and die makers as well as metallurgists. Incidentally this method of building-up solid parts from stamped laminations holds interesting possibilities in other than the electrical field, and designers have in some instances achieved some very practical results at low cost by this system.

Designers of new types of press equipment have contributed much toward speeding up and increasing the accuracy of manufacture of stamped metal parts. This is true especially in connection with the use of long lengths of coiled strip in automatic presses. In many cases these designers have successfully broken away from all traditions, as in the case of *Fig.* 3.

Punching Without Stopping Stock

This is a rear view of a high production continuous feed machine developed and manufactured by the Super Speed Press Corp., which in this instance is set up for blanking out sheet metal container tops from wide coiled strip. The die bed reciprocates in a horizontal plane—the amount of its travel approximating the amount of feed per piece. The punch member takes its motion directly from the crankshaft, the amount of stroke being adjustable. The resulting rotary motion of the punch face coincides at its lower arc with the reciprocating die on its forward stroke.

Gripped by the stripper, the stock is held between the punch and die—the whole thing traveling forward horizontally as the punch penetrates the sheet. Then as it passes the center the punch withdraws from the sheet, the stripper acting to clear the punch. The stock is fed forward by rollers controlled directly from the crankshaft through a variable speed drive. This can be adjusted while the machine is running, to synchronize motions so as to leave only a minimum amount of scrap. Note in the illustration that a mere skeleton of the sheet remains after work has been punched out.

A cam-operated feed roll lifter is provided to release the feed rolls when the stripper is in contact with the work and while piloting and forming are being done. There is no lost motion in recovery and no pause

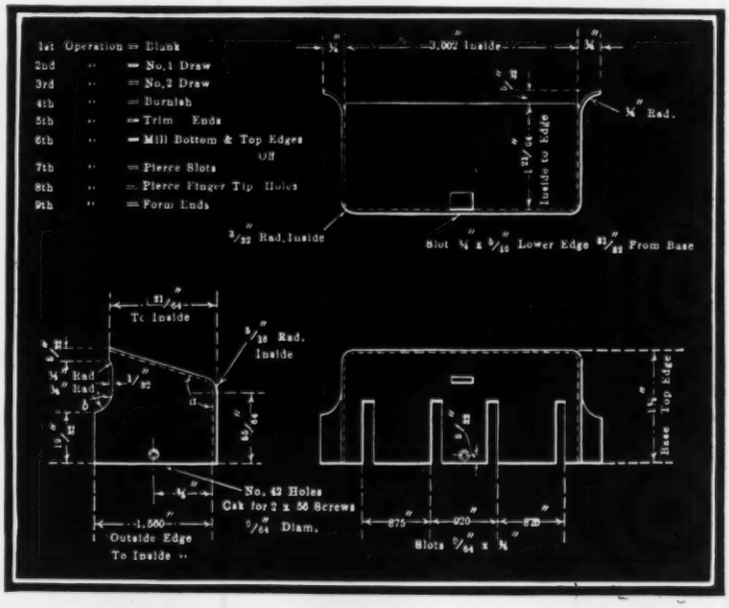


Fig. 5—Working drawing of pressed metal cover for a calculating machine, and schedule of operations involved

or "dwell" either of stock or tools. The machine takes standard die sets and avoids necessity for "gang" dies.

Obviously a press of this kind is strictly a high production proposition, as its top speed of 1200 strokes per minute will indicate. A collection of parts typical of work done by this press are shown in *Fig.* 4.

Just as any ambitious designer does well to cultivate the acquaintance and goodwill of patternmakers and molders, so also should he cultivate die-makers and press operators. He will thereby become "infected" with practical knowledge that will mean much to his own and his company's success. The ambitious designer also should make a careful and complete survey of the nature and capacity of the press equipment in his own plant, and should see to it that this detailed information goes on record in the standards book of the engineering department.

In casting about for a good example of a working drawing of a pressed metal part which would serve as an illustration at this point in this article, the writer studied many ranging from those of small watch parts to those of heavy motor vehicle parts. He finally located just what he was looking for in Frank A. Stanley's extremely helpful book, *Punches and Dies—Layout Construction and Use.* This is reproduced herewith as *Fig.* 5, and reveals the details

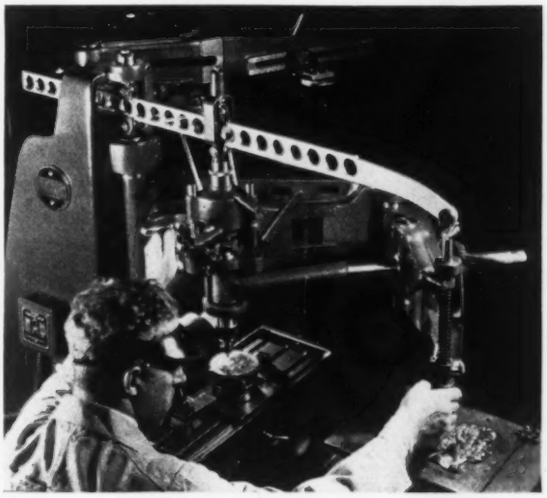


Fig. 6—Gorton three-dimensional pantograph cutting small, intricate die from large master

of a pressed steel carriage cover for a calculating machine, together with the sequence of press operations through which it is brought into being.

Incidentally, the designer should not overlook the matter of economy of metal. Especially when designing for big quantity production, attention should be paid to the manner in which the blanks will lay out on the stock. In *Fig.* 2 is an example of such economy.

Designers should also know something about the die making facilities in their own plant or in their die maker's plant. At this point we want to pay a de-

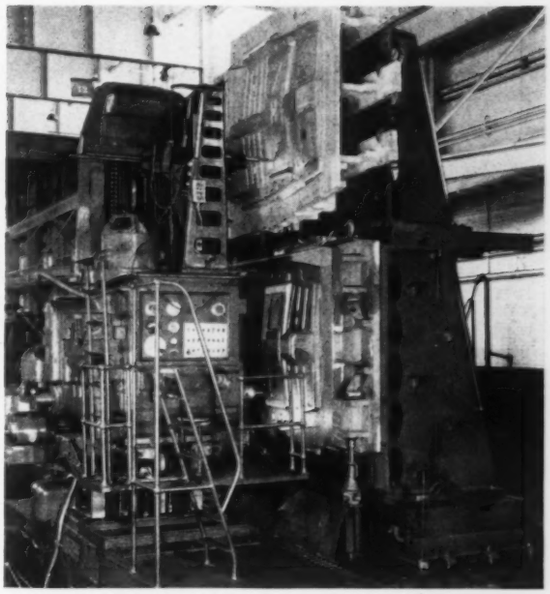


Fig. 7—Large Keller tool room machine cutting automobile floor board die from wooden model

served tribute to the engineers who have within recent years developed and perfected die sinking machines, both large and small. Not only have these remarkable machines relieved expert die sinkers of the yeoman tasks involved in roughing out dies, but they also have made possible the tremendous number of dies which are in use today, for the making of which there never could be enough skilled die sinkers if the work all had to be done by hand. Here most certainly is an outstanding example of machines which aid skilled workmen, but which do not displace them.

Examples of Mechanical Die Sinking

Shown in *Fig.* 6 is a Gorton three-dimensional pantograph cutting a small intricate die (left) from a larger "master" (right). The manner in which the high speed cutter is made to follow mechanically—on a reduced scale—the movements of the tracer, is clearly shown by the photograph of this ingenious precision machine. Note that vertical movement is attained through sliding action of the tracer and cutter spindles, thus keeping them perpendicular to work at any depth of cut.

As an example of the modern machine cutting of dies of very large size—the sinking of which would be wholly uneconomical—if not impossible—by hand methods—we present *Fig.* 7. This shows the largest of the Keller automatic tool room machines, built by Pratt & Whitney, in the act of milling a forming die for automobile floor boards under guidance of a tracer following a wooden model of the same size. The model is at the top of the vertical fixture and die is at bottom. While this machine weighs 154,000, its tracer—which functions electrically—is sensitive to .001 inch.

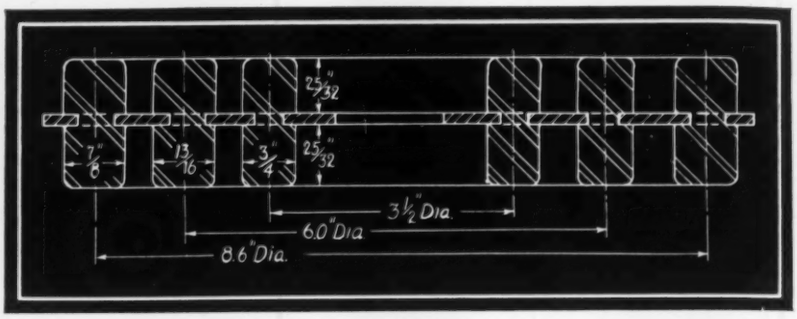


Fig. 1—Cross section of Spencer-Moulton rubber spring of round ring type, a design long used in England for buffers and auxiliary springs on railway cars and on locomotives

Understanding of Rubber Increases Engineering Uses

By F. L. Haushalter

WHEN considering rubber as an engineering material we should bear in mind that it is a vegetable product which on being coagulated from the sap of a tree becomes a closely packed mass of rubber globules or hydrocarbons separated by their adsorption film of protein, coming together with some precipitated protein and other serum substances, trapped between the particles during coagulation and drying. We should also remember that the carbon atoms of the rubber molecule lie in zigzag linkages of various lengths which straighten out when stretched, perhaps with free rotation at the points of the single bonds, for the molecule of the rubber hydrocarbon has the formula $(C_5H_8)_x$, x varying perhaps from 500 to 3000, with one double bond for every C_5H_8 group. Resistance to slippage of the molecule depends on the orientation of the linkages and on the value of the molecular cohesion, as measured by the Van der Waals forces.

Sulphur mechanically mixed with rubber combines with it chemically as a solution upon application of heat—and even at room temperatures. The change known as vulcanization is not a simple chemical phenomenon, for the rate of combination increases with concentration of sulphur and for initial concentration of sulphur the rate of combination remains constant until most of the sulphur is consumed. The rate of combination is also influenced greatly by the presence of accelerating substances, acting as catalysts.

Vulcanization greatly reduces the slipage or creep

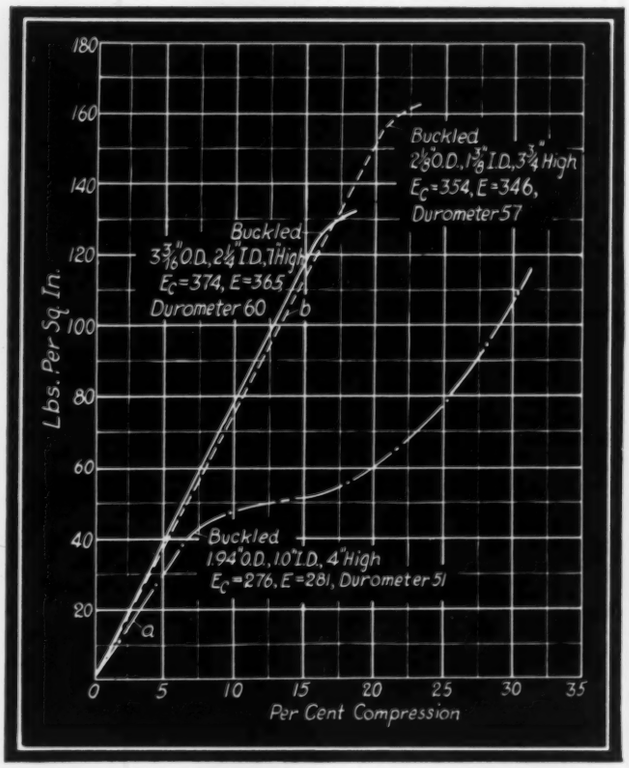


Fig. 2—Compression tests on three rubber cylinders, showing points of buckling

INCREASING importance of rubber as an engineering material was emphasized in several papers presented at the recent Providence meeting of the Rubber and Plastics division, A.S.M.E. One of the most interesting of these papers from the standpoint of design of machinery is presented herewith. The author of this paper is development engineer with The B. F. Goodrich Co., Akron, O.

in the molecular structure of the rubber. Evidence indicates that bridges of sulphur tenaciously join together the molecular structure with an attending stiffening action. Vulcanization is undoubtedly an establishment of cross bonds, perhaps crystalline in character, between long chain fiber molecules, both chemical and mechanical in nature.

When rubber—either raw or vulcanized—is stretched, it becomes warm, and when stretched even small amounts the heat generated increases sharply above 70 per cent extension. The mechanical work done on the rubber when it is stretched is only a small percentage of the total latent heat. Hence, the heat generated is something more than friction; it may be potential energy, stored by strain of an assembly of oriented single molecules, and when the rubber is stretched there is an evolution of thermal energy corresponding to a heat of crystallization. Likewise, rubber stretched to a given percentage, on being heated, contracts.

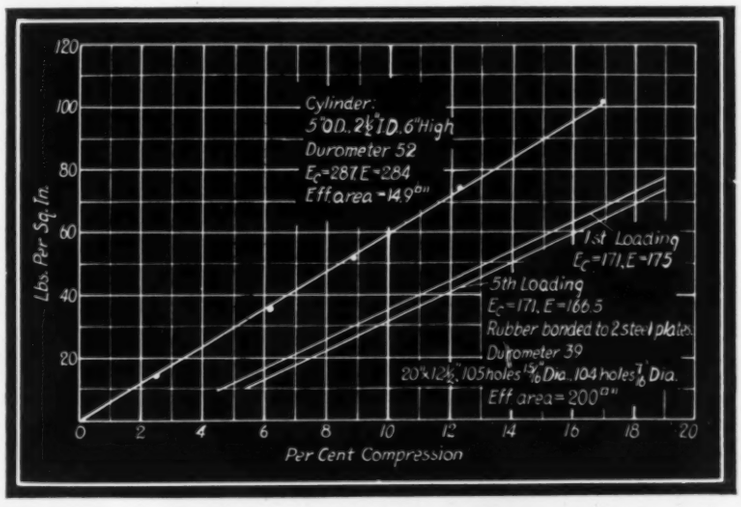
There is a tight packing of the rubber molecules as rubber is stretched because there is a slight increase in density and a very appreciable increase in apparent hardness. This closing up of the structure greatly reduces the susceptibility of the rubber to attack from oxygen, its deadly enemy. The greatest vulnerability of rubber to oxygen or ozone is just at the point of change of hardness; the effect then rapidly diminishes as the hardness increases. It has also been found that the susceptibility of vulcanized pure gum to tearing is greatest at from 50 to 150 per cent elongation.

Rubber in tension is used but little by engineers, although there is no good reason for not using it more extensively now that rubber can be bonded securely to metal. Rubber can be used safely in tensions up to 30 or 40 pounds per square inch and when working within this region of elongation the load-deflection curves for stocks with a high rubber content are very close to a straight line. This means that the modulus of elasticity is very nearly a constant within this range. For a pure-gum vulcanizate of about 40 durometer, the modulus of elasticity is about 180.

Rubber has longest been used by engineers in compression, as for instance in buffers, shock absorbers and bumpers of various types. It is the author's experience that compression rubber as a load-carrying member should be limited to 20 per cent compression under normal loading, the chief reason being to keep the creep or drift in the rubber to a reasonable figure. Too often compression pads have been used under loads which distorted the rubber badly causing it to take on excessive creep in a short time.

In loading rubber cylinders one must maintain certain proportions of width to height and cross-sectional area in order not to get into trouble from collapse of the member when used as a column. This is especially true when the member is to be subjected to lateral forces as well as vertical. *Fig.* 2 shows tests on three cylinders, and their point of collapse. To determine what these proportions should be might well be worth the effort of an ambitious author who wishes to make a mathematical treatise of rubber cylinders, for rubber cylinders do afford a simple means of isolating machines where compliancy both in vertical and horizontal planes is desired.

In *Fig.* 1 is shown the cross section of a round ring type of rubber part which has been used in England for a great many years as buffers and as auxiliary springs on railroad cars and locomotives. These are known as Spencer-Moulton springs. Holes



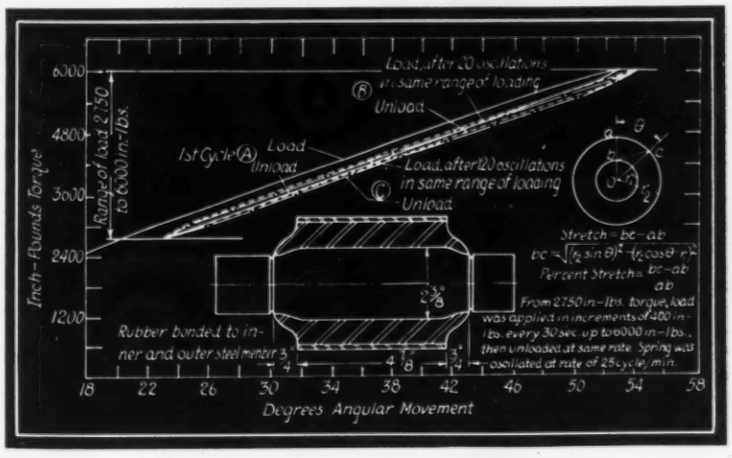

Load after 120 oscillations in same range of loading
Unload
1st Cycle (A) Load
Unload
Load after 120 oscillations in same range of loading
Unload
Range of load 2750 to 6000 in-lbs.
Inch-Pounds Torque
Stretch = bc − ab
Percent Stretch = bc − ab / ab
From 2750 in-lbs. torque, load was applied in increments of 400 in-lbs. every 30 sec. up to 6000 in-lbs., then unloaded at same rate. Spring was oscillated at rate of 25 cycle/min.
Rubber bonded to inner and outer steel meter
Degrees Angular Movement

Fig. 3—Upper—Loading curves for neoprene rubber cylinder designed to carry 1100 pounds, and for rubber slab designed to carry 16,000 pounds

Fig. 4—Lower—Single unit rubber torsion bushing, with typical loading curve showing that, after 120 oscillations through 2750-6000 inch-pounds range, spring rate becomes nearly constant

in the steel plate tie in the rubber rings on either side. Adding together the cross-sectional area of the rings we find that the factor 6.5 applies for this design.

Fig. 3 shows a loading curve for a cylinder of neoprene designed to support a load of 1100 pounds, also one for a rubber slab designed to support a load of 16,000 pounds. The curves are straight lines in the working range. There seems to be no difference between the modulus of elasticity of neoprene and that of natural rubber of the same durometer hardness. The rubber slab consisted of two steel plates with rubber bonded between them. A great number of holes through the slab allowed compliancy. One curve is for the first loading and the lower one for the fifth loading. This is characteristic of all compression loading tests but in this case the effect is somewhat exaggerated due to the network construction. Furthermore, the straight portion of the curves do not pass through the origin. This is undoubtedly due to lack of uniformity in the thickness of the slab, giving a greater apparent deflection near the origin.

If we deflect the rubber of a 10 x 5 x 1-inch thick shear sandwich 1-inch in shear, the elongation in a strand of rubber perpendicular to the two steel plates to which it is bonded will be 41 per cent, since the new length of this strand will be $\sqrt{2}$ inches. This strand forms practically a straight line, although it is perpendicular to the plate for a short distance even when under load.

What is the practical limit of thickness of rubber to be used in the shear-type springs? If, in the foregoing

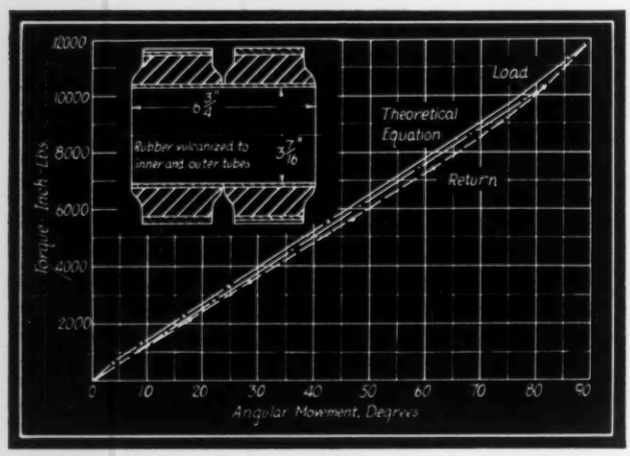


Fig. 5—Double unit torsion spring, with graph showing that up to 70 degrees it has straight line characteristics conforming closely with theoretical curve

example of bending, we increase the thickness of rubber to 2 inches, the deflection due to bending will be eight times that obtained with rubber 1 inch thick. The increased softening due to bending and the fact that the time of vulcanization of rubber varies approximately as the square of the thickness would seem to limit the maximum thickness to 2 to 2½ inches per section.

The thicker the rubber the lower the temperature of vulcanization to be used in order to obtain uniformly cured rubber throughout the mass, so the cost of curing becomes an important item where long time cures must be used on every section.

Rubber torsion bushings of the type shown in *Fig.* 4, can be designed by use in the formula

$$\theta = \frac{WL}{4\pi bG}\left(\frac{1}{r_1^2} - \frac{1}{r_2^2}\right)$$

where θ = angular deflection, radians; WL = torque, in-lb.; b = effective length of rubber section, in.; G = modulus of elasticity in shear, lb. per sq. in.; r_1 = inner radius of rubber section, in.; r_2 = outer radius of rubber section, in. In a design of this type the rubber is stressed higher near the center metal member than near the outer metal member because the volume of rubber increases with the square of the radius.

A typical loading curve of the bushing of *Fig.* 4 is also shown. The graph was made to show that after 120 oscillations through the loading range of 2750 to 6000 in.-lb. torque, the spring rate becomes very nearly constant as the slope of the curve indicates; for this particular spring the rate being 100 in.-lb. per degree. Some hysteresis loss is shown between the loading and unloading curves even after 120 oscillations of the spring, but under a rapid cyclic test at a speed approximating spring action in service, the hysteresis loss would diminish very much below that shown. Hysteresis loss diminishes materially with temperature rise in the rubber and also with speed of oscillation. The inherent damping, therefore, of a spring of this type, using rubbers designed to keep the creep to a minimum, is of a low order, although the little there is may be beneficial under certain conditions of service.

Multiple Units for Extreme Torsion

Fig. 5 shows a double unit torsion spring of such design that nearly a straight-line characteristic is obtained up to 70 degrees as shown by the graph. The heavy dot-dash line was plotted from the theoretical equation given above, showing close conformity to the empirical curve. The rubber units act in series to give twice the angular deflection for a given torque as would be obtained with one bushing. Series arrangements of this kind can be used to obtain very large distortions without going to excessive thicknesses of rubber wall.

Other constructions may be used such as pressing a bushing—made up with 50 durometer rubber—into another bushing which has rubber of durometer 40. These bushings are also in series arrangement for obtaining large angular movements, the hardness of rubber being graded off in order to obtain approximately equal angular movements in each bushing.

In bushings of this type the best practice is to bond the rubber to a central metal tube and to an outer shell split in halves. By doing this, full pres-

(*Concluded on Page* 71)

Machines Aid Housewives!

By R. H. Jordan

Engineering Dept., A. C. Gilbert Co.

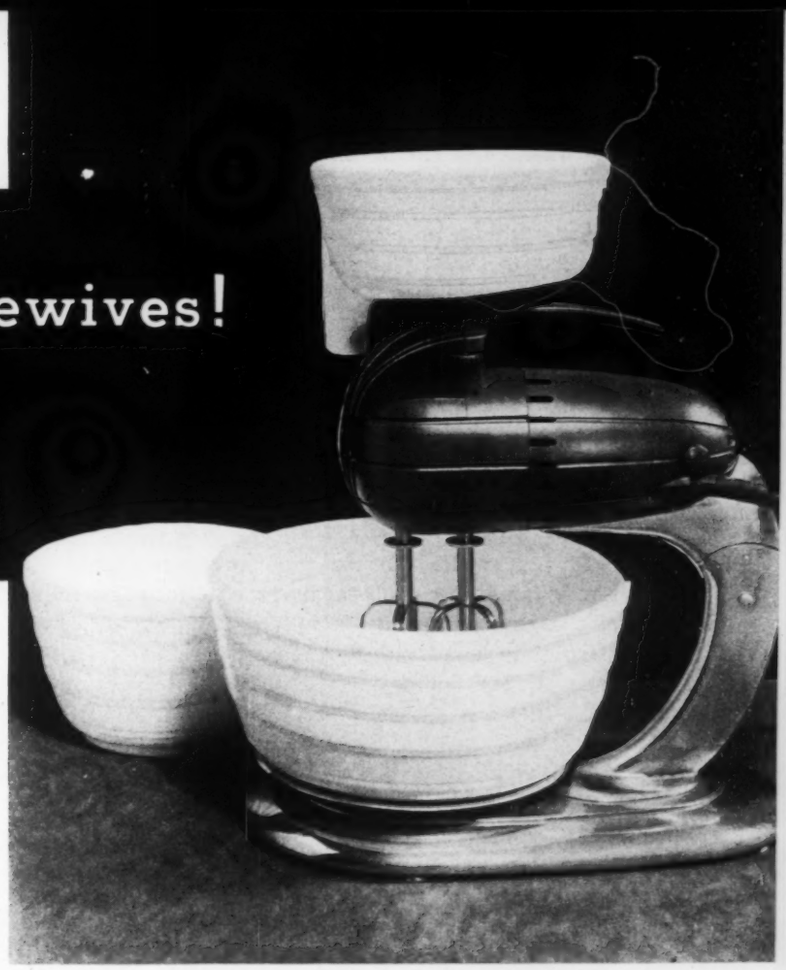


Fig. 1—New Gilbert Kitchen-Kit is a good example of results attained through cooperation of men in charge of styling and engineering. It combines appearance with performance

PROPER mechanical and electrical design of the motor, the gearing, and the control was considered the prime essential of the new Gilbert Kitchen-Kit shown in *Fig.* 1. Second in importance were those features which do not actually add greatly to the mixer's efficiency or lasting qualities, but do make the unit desirable. Examples are styling, material and finish, elimination of points of possible trouble, simplicity of operation, weight. Other special characteristics may not be absolutely required in a mixer, but increase its utility so that it is capable of performing a number of jobs. Power gearing and the attachments are included in this category.

After thorough investigation it was found that from ⅛ to 1/10-horsepower was required for the toughest job a mixer has to do, grinding meat. This investigation of power was responsible alone for the design of the motor parts and gearing. Under normal mixing conditions there was perhaps too much power available, but this is not a disadvantage if proper speed regulation is provided. Therefore, a great variety of speeds, which would not vary with the load, was essential to eliminate overbeating of cake batters. At the same time full, or nearly full, torque on all speeds was necessary.

Two methods were available to attain these ends, both operating on the principle of closing and opening the current supply circuit. Obviously, the speed of the appliance varies proportionately with the rapidity of making and breaking the supply current. One of the constructions operates by centrifugal force, the other by air force. Decision to use air force was prompted by the following thoughts.

The centrifugal governor, it was found, occupied considerable space because the entire mechanism, rather bulky, had to be mounted on the shaft. With the air type governor, only the pressure vane had to be located next to the cooling fan, the rest of the mechanism being adaptable to fitting into a space of al-

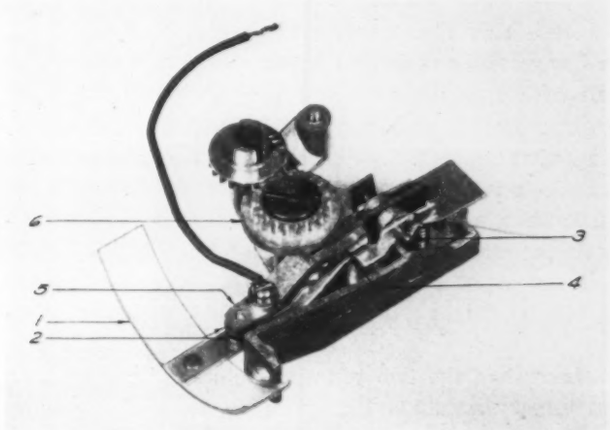


Fig. 2—Assembly of the air type governor which regulates the speeds of the beater, regardless of load, and permits full torque at all speeds

most any shape. This fact was important because other reasons had made it necessary to arrange the gearing for the beaters in interlocking tandem on one side of the motor shaft. The other side was left unused except for such mechanisms as the governor.

A second point in favor of the air-type governor was the location of the switch handle. The most logical position for it was in the handle of the mixer, for thumb operation. Any other place would not be as handy when the device was used without its stand, such as in stirring over a stove. The air type governor proved more adaptable to such construction than the centrifugal type.

Finally, while the air type governor requires a strong fan, it also cools the motor efficiently. Assembly of the governor is shown in *Fig.* 2. This piece is assembled in a separate department because of its precision. After thorough testing it is added to the motor.

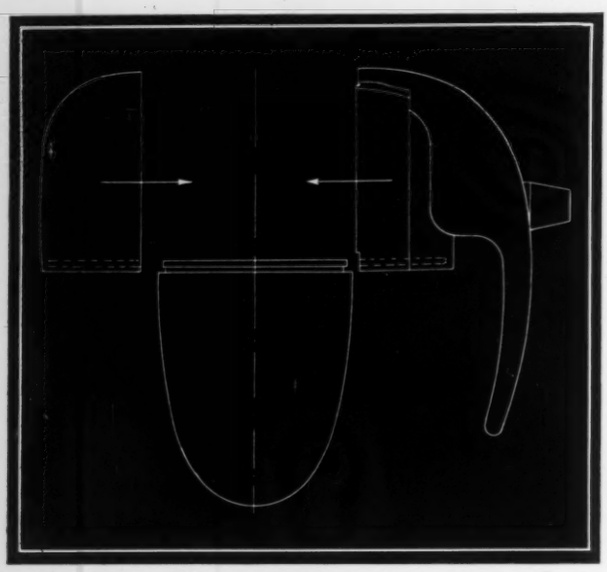


Fig. 3—Construction of the mixer, schematically shown here, involves a minimum number of screws, using instead a bayonet groove around the motor housing and a corresponding tang on the front gear housing

Since this type of control is comparatively new, a few words in regard to its function are in order. The air-vane 1, is made from a very stiff, yet extremely light material, and is located adjacent to the cooling fan of the motor. It is carried by an arm which also carries one of the two tungsten contact points, 2. Its fulcrum is at 3, and an adjustable spring at 4 counteracts the airstream from the fan.

Air Pressure Breaks Circuit

Second of the two tungsten points is fastened to a stationary arm, 5, which can be lowered or raised by means of the cam wheel, 6, actuated by the switch knob in the handle. Lowering the stationary point will also lower the other point, thus increasing the distance between fan and vane, also increasing the tension of the spring at 4.

It is obvious that in this case, considerably more air pressure is required to force the two points apart. The higher air pressure is synonymous with a higher speed of the motor. At any one speed, therefore, the contact to the power line is maintained as long as the two points touch. As soon as the speed or air pressure increases until the points are forced apart, the current supply is interrupted and the motor slows down until contact is re-established and the same cycle is started again.

Molded material for the complete housing was selected because of its qualities of lustrous finish, light weight, possibilities for styling, sales appeal, cleanliness, proof against chipping, coolness to touch even under hard operating loads, and proof against shock.

When styling came under consideration, a rough layout of all inner parts, plus clearances, was made and given to the artist, who in turn designed the outline. Frequent discussions were necessary at this stage to decide upon a design which fully satisfied both artist and engineer.

Good styling in most cases makes for simplicity, and necessitates getting away from conventional types. The modern lines and chosen material of the mixer's housing brought about many unique designs during its development.

Screws Concealed If Possible

An example concerns visible screws and nuts. The screws must be placed somewhere, but it is up to a good designer to find places where they show the least, and to evolve constructions which need a minimum number. The design adopted consists of a bayonet groove all around the one-piece motor housing, and a corresponding tang in the front gear housing. The latter is split in a horizontal plane and thus clamps on the motor housing when screwed together. This construction is schematically shown in *Fig.* 3.

Another deviation from the conventional was employed for attaching the labor-saving devices to the power outlet. A third power outlet always has been a feature of Gilbert mixers. This eliminates the necessity of carrying and connecting a low speed unit to the mixer for the use of the attachments. Previously, however, the attachments were held in place, without exception, by a pin or thumbscrew. A new method had to be found to eliminate this unsightly screw, and a simple solution was found by utilizing a bayonet lock which locks in the direction of rotation of the power shaft.

Another feature worth mentioning in connection with the relation between styling and mechanical design is the tilting mechanism. The streamline design of motor and base placed the hinge joint so far back that it seemed very undesirable from a mechanical point of view. If the motor were to be tilted so

far back that the center of gravity would fall on the other side of the hinge, it would not only be high in the air, but unstable. Moreover, if the motor unit should accidentally fall forward, it would do so with extreme force which might involve injuries.

Save for an entire change in design, the sole answer to this predicament was a spring arrangement inside the base which was strong enough to hold the motor up so that the beaters were above the bowl when the latter was removed. *Fig.* 4 shows how this was accomplished.

Coil Springs Keep Motor Tilted

A strong coil spring presses against a protruding part of the tilting bracket, whereby the point of pressure is now located so that the two extreme positions are on either side of the line of maximum compression. This construction not only holds up the motor securely in its tilted-back position, but it also holds the beaters down in normal operating position. This is important because a heavy mixture has a tendency to push the beaters up out of the mixture. Hence they ride on top of it instead of through it.

One of the most troublesome problems in a household mixer is the tremendous axial thrust of the motor shaft. This thrust is caused directly by both beater spindle gears if, as customary, they are arranged on either side of the shaft. The thrust is considerably less if the gears are both on the same side of the shaft, because only the differential of the load on both gears, never quite equal, will then be responsible for the thrust.

But there will be no axial thrust when these two gears are also meshed with each other. The entire differential thrust is then taken up by the combined assembly of the worms and gears, leaving the shaft locked in position without the slightest axial movement. Greatest difficulty encountered by thrust is the inability to lubricate properly between the parts in contact. The tremendous pressure and speed simply drive away the lubricant and often cause a screeching noise. Much of the machine's power is lost because a part of it is transformed into friction heat.

Round Brushes Mounted Acutely

Another unusual scheme has been employed in the arrangement of the brushes. In order to eliminate molding seams and at the same time make the motor housing more substantial, brush tubes could not be molded in place. They had to be pressed in place after molding, thus making a round shape necessary.

Round brushes sometimes turn and cause noise and undue wear. Square brushes do not have these disadvantages, but it would have been costly to make the tubes round on the outside and square on the inside. The idea was then conceived of using round brushes mounted at an acute angle to the axis, rather than at a right angle as customary. Round brushes thus mounted will operate just like square brushes, it has been found. They definitely cannot turn.

The arrangement of the speeds on the switch is a good example of those improvements which were not made to avoid known trouble but to add special features. Usually the switch is operated from the "Off" position through the lower speeds to the highest. All speeds must then be crossed to return to "Off" and stop the motor. The switch on the Gilbert Kitchen-Kit is arranged so that from "Off" the operator can go directly to high and continue in the same direction to reach the lower speeds and the "Off" position again. Conversely, when the switch is turned in the opposite

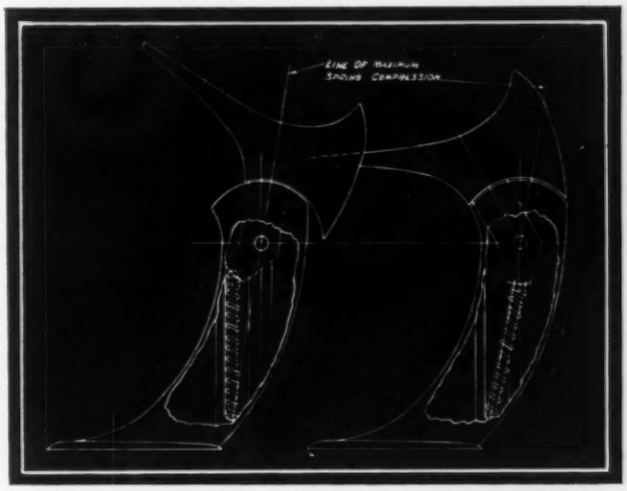


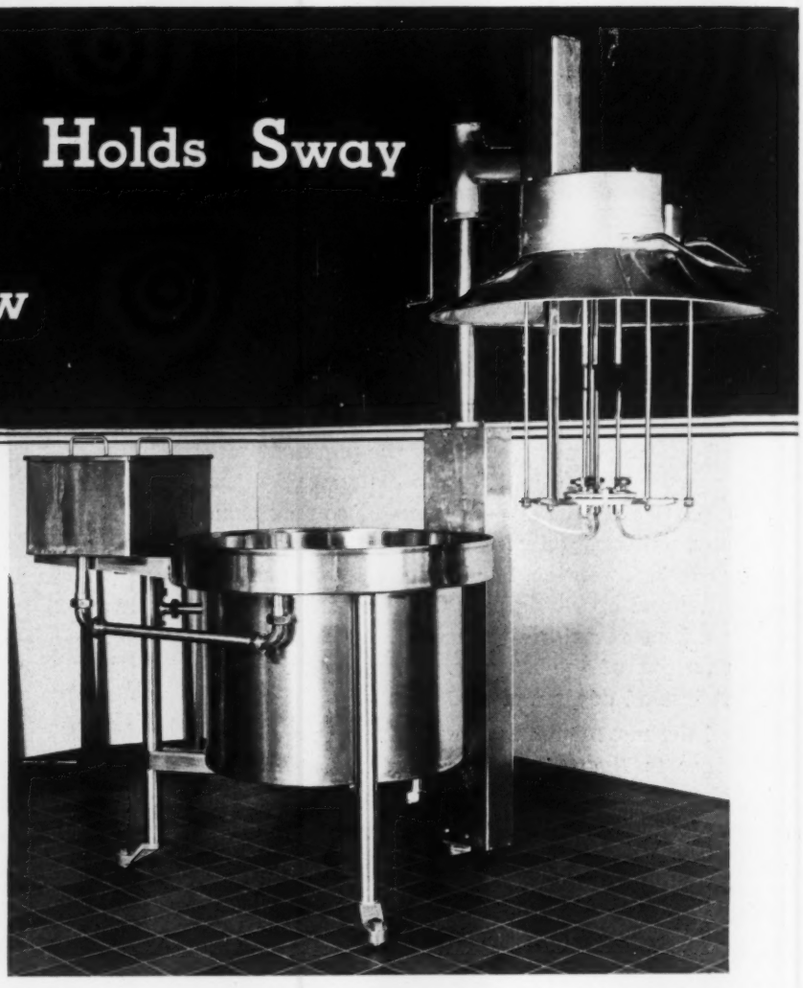
Fig. 4—This spring arrangement inside the base was made strong enough to hold the motor up so that the beaters are above the bowl when the latter is removed

direction, the lower speeds are obtained before the high speeds. This universal type of switch makes the mixer more flexible and adds to the utility.

Beaters also must be planned carefully. Principles back of their relation in design to the rest of the mixer have bearing on other types of small machinery which may have accessories. Of paramount importance is their ease of cleaning, brought about by elimination of crevices where bacteria thrive. Beaters must be sturdy. And they must cover the entire bowl area, to maintain maximum efficiency. For foolproof operation, they should be attached simply. Finally, in considering materials for use in beaters, the numerous advantages of stainless steel cannot be overlooked.

From the foregoing discussion, one thought in particular stands out: Complete cooperation between men in charge of styling and engineering is an absolute necessity for successful design. If either should insist on certain details, the proper design may be virtually impossible. In most cases, as a matter of fact, the mechanical design will be greatly improved because the styling forces the engineer into new channels of thought. Something new, and frequently something better, is likely to be the result.

Stainless Steel Holds Sway at Dairy Show



Milk irradiator made by National Carbon Co. is assembled of welded 18-8 stainless steel. It utilizes a 3-phase carbon arc lamp which throws ultraviolet rays on thinly-spread milk falling down the sides

IF ANY single theme can be said to have influenced the design of machinery exhibited at the Dairy Industries Exposition in Cleveland last month, it was that of sanitation. An observer could not help but be struck by the efforts being made to produce equipment which prevents contamination of processed dairy products.

At the same time dairy machinery is becoming increasingly versatile and fast. Every year more jobs—formerly done piecemeal or by hand—are taken over by efficient equipment. Where last year a bottle-capping machine would cap 20 bottles a minute, it will now service 35. Larger machines will handle 50 or 60 bottles each minute. And so it goes in every phase of dairy work.

It has been no secret for several years that stainless steel, especially the 18-8 analysis, has a vast variety of potentialities in the dairy machinery field. As in many other industries, stainless has been recognized as invaluable where corrosion resistance is a serious factor and where light weight is important.

Stainless Gains Despite Cost

But the gains registered by stainless in dairy equipment during the past year are startling nevertheless. For a while the greater cost of stainless led many manufacturers to refrain from its use in their dairy machinery. It was deemed more advisable to use other metals, even if they demanded occasional replating or replacement.

This picture has changed. Dairy equipment makers now prefer to use stainless in the initial design, in the firm belief its greater cost is soon justified in lower upkeep and greater satisfaction. Non-corrosive steel is used not only for side walls of tanks or for chutes through which milk flows, but for actual working parts which may be close to milk products.

"Streamlining" in some degree or manner is a characteristic of all modern machinery, but its extent tends, in general, to vary with the function of the apparatus. Apart from actual streamlining of transportation equipment and from appearance "streamlining" of other types of machines, the smooth-flowing curves of dairy machinery are closely related to greater cleanliness. Cracks and crevices are feared as potential breeding places of harmful bacteria. Steps taken to avoid sharp corners and crannies are all to the good. Accordingly, parts of dairy machinery which are likely to be near or in contact with lacteal products are generally being rounded off.

Welding is being employed increasingly for construction of dairy machines because it obviates the

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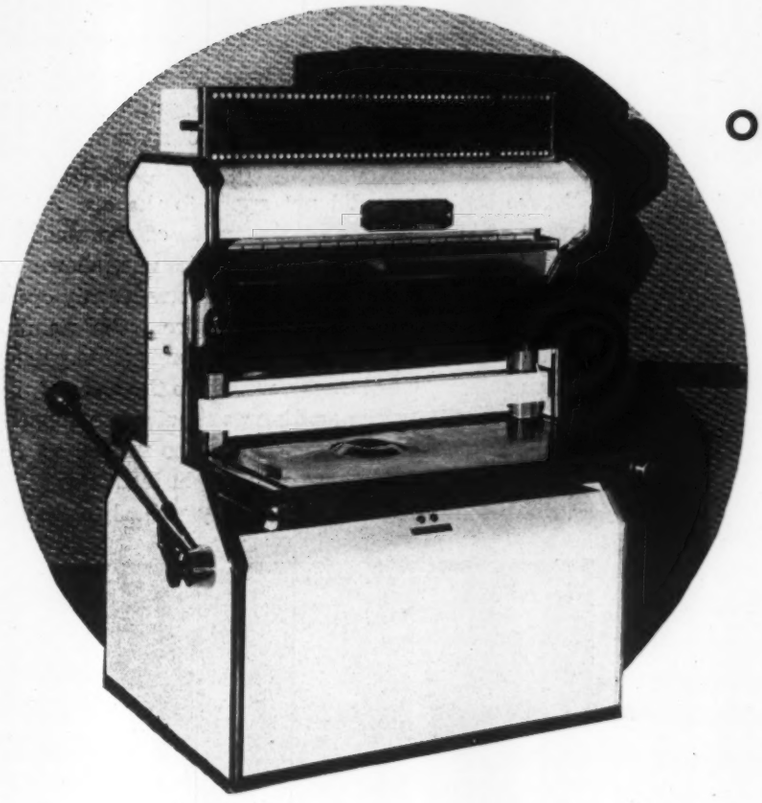
Welding Brings About Redesign of Bread Slicer



By Ernst Duesing
Oliver Machinery Co.

SOON after the initial manufacture of bread-slicing and wrapping machines by the Oliver Machinery Co. in 1933, arc-welded steel design was instituted for two reciprocating frames, suspending the slicer knives. *Figs.* 1 and 2 show the frames assembled and dis-assembled. The box section chosen for supporting members of the steel frame reduced the weight by 10 per cent, allowed a 50 per cent higher loading, decreased the cost by 30 per cent. For more than two years, however, these frames remained the only arc-welded parts on the machine. Late in 1936 the bread slicer was redesigned and more opportunities arose for use of welded steel.

The knife frames are the principal parts of every bread slicer used for large scale operation. Unlike the straight up-and-down movements of the knives in the majority of bread slicers, the knife frames in the Oliver machine do not travel in a straight line. This design, as illustrated in *Fig.* 3, makes possible the use of durable ball bearings at all moving points. Since this arrangement proved satisfactory on the original machine, it was only logical to adopt it for the new arc-welded bread slicer.

Our fears that it might be difficult in the arc-welded frame to obtain accuracy and good alignment necessary for the use of ball bearings were soon dispelled. In fact, after completing the welding jigs for the assembly of the steel frame, the new method was found not only to be cheaper but to provide a much higher degree of accuracy than had been secured previously.

The rocker, *Fig.* 4, an end view of which is shown in *Fig.* 3, is supported at the ends by the two ball bearings marked *A* and *B*. In the former frame it was necessary to have the bearing on one end of the rocker floating, because the distance between the two ball bearing housings varied as much as ⅛-inch. Close

NUMEROUS advantages of welding are discussed in the accompanying article, based on a prize-winning paper entered by the author in the recent competition sponsored by The James F. Lincoln Arc Welding Foundation. Mr. Duesing's paper contains many ideas that are worthwhile in the consideration of welding by engineers responsible for the design of machinery and parts

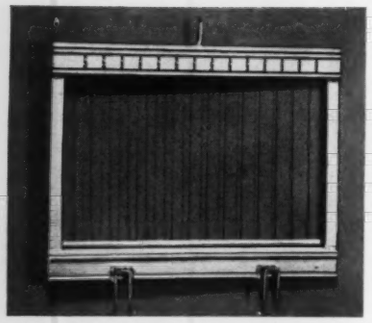


Fig. 1—Reciprocating knife frames are the principal parts of bread slicer. This is the Oliver arc-welded steel frame assembled

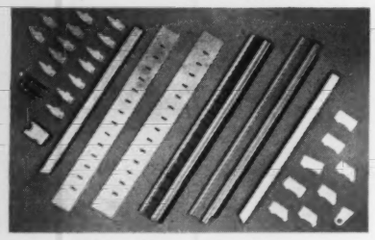


Fig. 2 — Disassembled parts of the knife frames. Weight was reduced 10 per cent, cost 30 per cent, by utilizing new method of construction

observation shows that on the steel frame this distance never varies more than .015-inch. Even this variation is probably not caused by the welding but by the slight unevenness of the plates used for sides.

Since the 3/16-inch side plates are not heavy enough to support a ball bearing, bushings are welded into the sides of the frame. These bushings, at low cost, are made from steel tubing on an automatic turret lathe. Except for a distance slightly less than the thickness of the plates, the outside of the tubing is left unfinished. The end is turned down to fit into a hole punched into the side of the frame, the hole in the bushing being reamed to approximately .0005-inch to .001-inch below ball bearing size. Correct size is obtained with a hand reamer at the final assembly of the machine.

Load Requires Solidly Welded Housing

A retaining box or housing is provided for the two ball bearings supporting the crank and pulley assembly. As illustrated in *Figs.* 3 and 4, the rocker which supports the lower end of the up-and-down moving knife frames is kept in motion by the crankpin. A connecting rod joins the crank and the rocker. The pulley, forming part of the crank, is driven by a motor mounted on the side of the machine. Some trouble was originally encountered with this housing. The heavy, continually changing load created by the unbalanced crank required both a solidly welded housing and a retaining hole perfectly true in size and shape.

In the old slicer a motor bracket, a clamp, seven bolts, nuts, and washers, and ample space were required to locate the motor on the bottom of the machine. In the new design, the motor bracket is completely eliminated. Instead, four studs, simply welded to the side of the machine, four nuts and washers are all that is required to mount the motor. This arrangement, plus the fact the steel side plates were stronger than the former walls and therefore did not require reinforcing, reduced the base area of the machine by 60 square inches.

The bread feeding arrangement of the old style slicer was frequently another source of trouble and complaint, being a separate unit attached to the main housing by screws and bolts. An addition of bearings, bosses, and slides on the housing would have resulted in an increase of machining operations to a point where profitable sales would have been doubtful. This handicap was responsible for a bread pusher that was awkward to operate, because plenty of space was needed on either side.

These limitations did not apply to the arc-welded design. Through links on the inside of the machine the loaf pusher is connected to a handle, shown in *Fig.* 5, which is not only easily and conveniently operated, but also removes the hands from the vicinity of the fast-cutting knives. The pusher itself is guided by two stainless steel tracks, welded to the sides of the slicer frame. Bearings and bosses required to support a system of links and levers were also welded to the frame. In one place, where only a light load is applied, a steel retainer bushing was simply welded to the in-

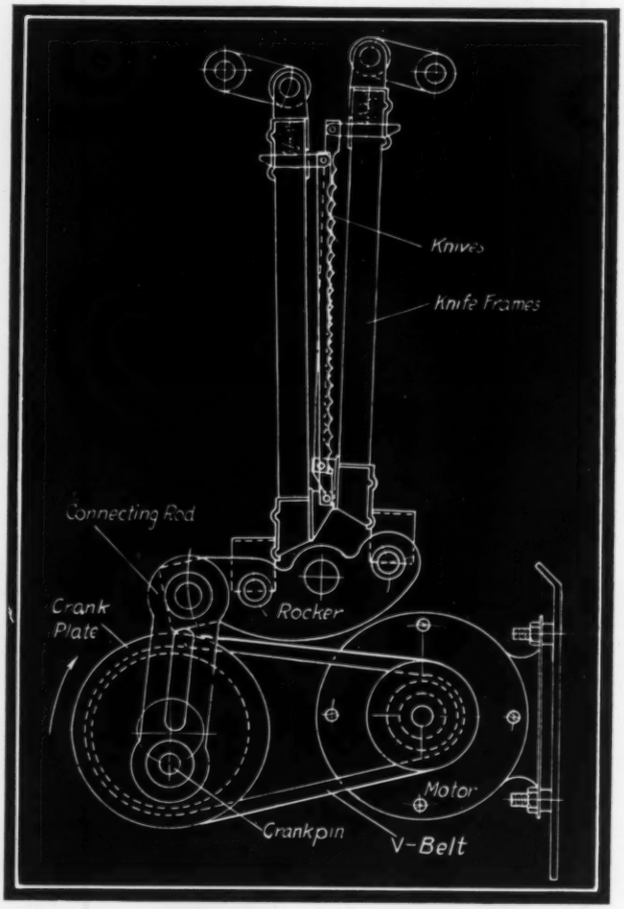


Fig. 3—Oliver knife frames do not move in a straight line. The design illustrated makes possible the use of ball bearings at all moving points

side of the frame. An oilless bushing is pressed into the steel retainer.

Of utmost importance for economical production of arc-welded parts and machines, of course, are means to locate and hold the separate parts while the welding takes place. The number of units that are expected to be made should be the only limiting factor in the design of these fixtures. For the steel housing of the slicer six fixtures are used. Principal parts of

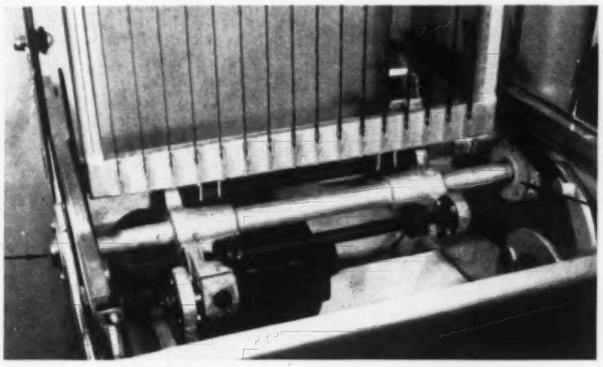
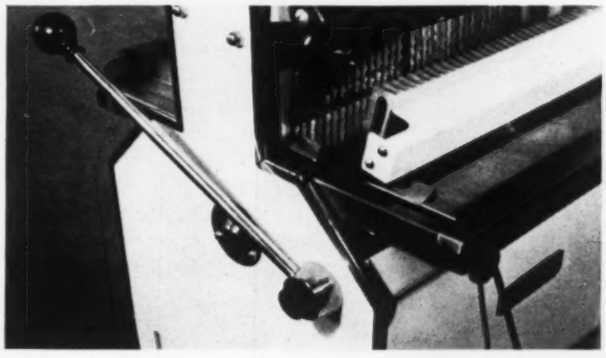


Fig. 4—The rocker, end view of which is shown in Fig. 3, is supported at the ends by two ball bearings

Fig. 5—Through links on the inside of the machine, the loaf pusher is connected to a handle which operates easily, removes hands from vicinity of knives



the frame are the two sides, the front and rear plate, and the top cover. To these, in separate jigs, are welded the various parts before the final assembly of all the parts is undertaken. All parts of the frame are made of 3/16-inch cold rolled steel, while ⅛-inch stock is used for the top cover.

While the welding jigs are merely flat plates designed to locate the various studs and bearings and to assist in keeping the welded units from warping, the welding fixture for the final assembly of the frame has to serve a more difficult purpose. The separation of the welding operations up to this point has made possible the welding in flat position. To obtain the same ease of operation in the final welding of the unit, this last fixture has been made so as to permit rotation around a horizontal as well as a vertical axis.

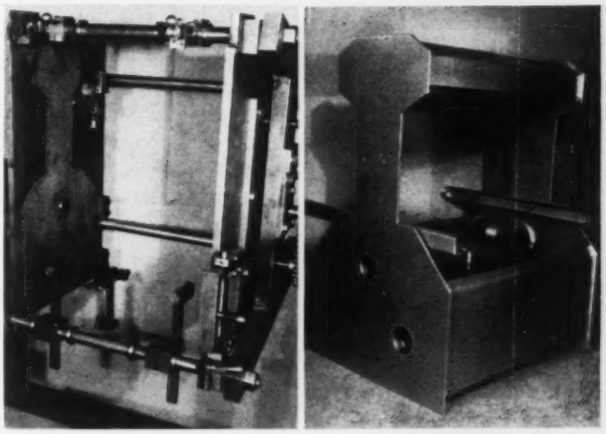


Fig. 6—Left—Welding fixture for final assembly of frame requires little handling in locating and clamping principal parts, produces perfectly square and level housing

Fig. 7—Right—The slicer frame as it leaves the final welding fixture. Except for light cleaning from welding slag, it does not require any additional machining

The fixture is easy to operate, requires little handling in locating and clamping the five principal parts and in removing the finished product. It produces a housing perfectly square and level. As will be noted from the accompanying illustration, *Fig.* 6, this fixture too is made entirely of steel, welding being used throughout its construction.

Frame Needs Little Machining

Fig. 7 shows the slicer frame just as it leaves the final welding fixture. Except for a light cleaning from welding slag it does not require any additional machining operations. In this state it is ready for bonderizing and painting. Thirty-four parts welded into one solid unit are required to build this frame. The time needed is relatively small. Our experience has refuted the contention that the only economical arc-welded constructions are those made of few parts.

It is surprising, moreover, that the cost of making our present slicer is not the lowest possible figure. Several parts are still being made without the help of fixtures. In fact, the first few slicers were built entirely with equipment already in our possession. These served as test machines to prove their utility and as demonstrators to ascertain a demand for such a slicer. Arc welding, applied in this manner, can reduce the risk taken by manufacturers in the development and sale of any new product.

Production cost of the new steel frame is 30 per cent lower than that of the old housing. At the same time, a greatly superior machine has resulted. It is our belief that this saving may be applied to many other similar designs. So firmly are we of this opinion that we are now redesigning another machine used in the food industry, a meat saw. It too will be assembled from arc-welded steel.

American photoelectric cell dental cabinet, right, was designed to make it possible for dentist to open drawers of instrument cabinets without touching the drawer or drawer knob, possible sources of subsequent infection.

The Corona Zephyr typewriter, left, has unit construction assembled in a sturdy, all-steel frame. The jacket incorporates a new design idea, closing in the bottom as well as the sides and top, giving more perfect balance during operation and preventing forward-creep. Escapement rack teeth are of the involute style

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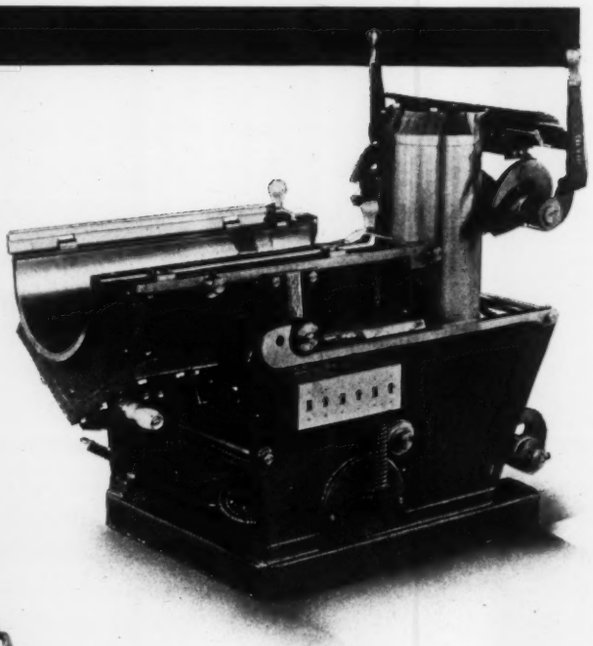

Claimed to be the world's largest hydraulic press for the shearing and forming of airplane parts, the Birdsboro machine, below, has a platen area of 200 by 90 inches, a 54-inch stroke, and can exert a working pressure of 5500 tons. Speed and pressure are fingertip controlled

A specially-built insulated back on the Goss vacuum curved plate casting box, left, promotes greater uniformity of stereotype casting temperatures. The box is electrically heated, units being automatically cut out by an adjustable thermostatic control. Cooling water is preheated in the core by a circulating system

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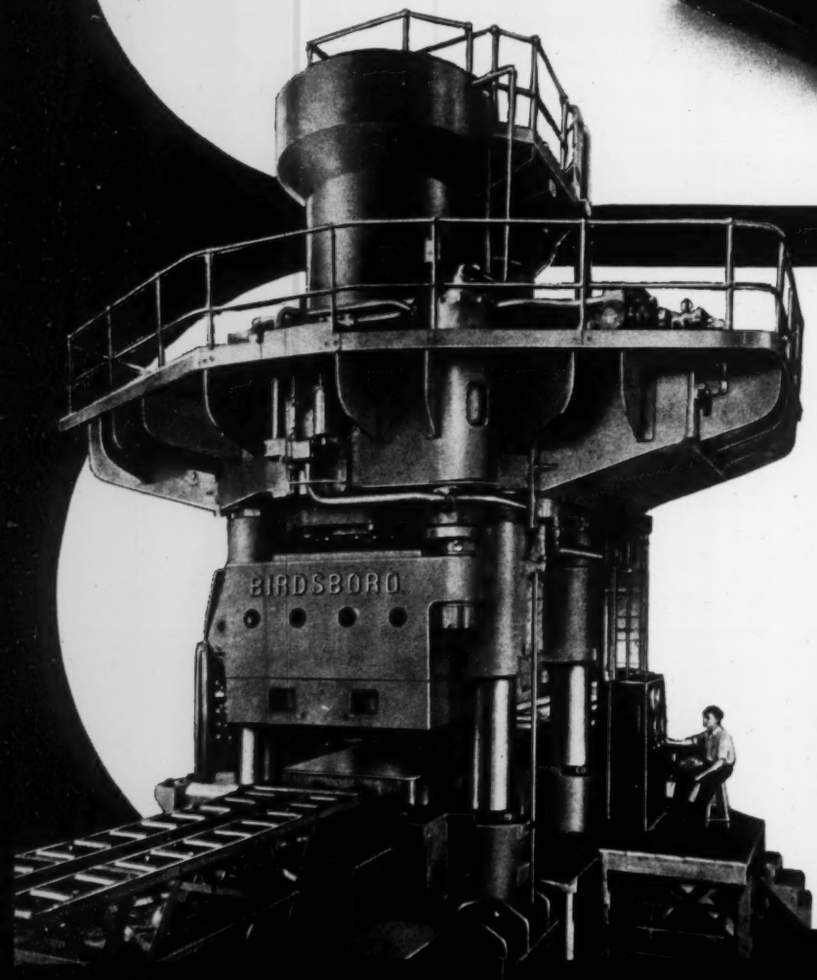
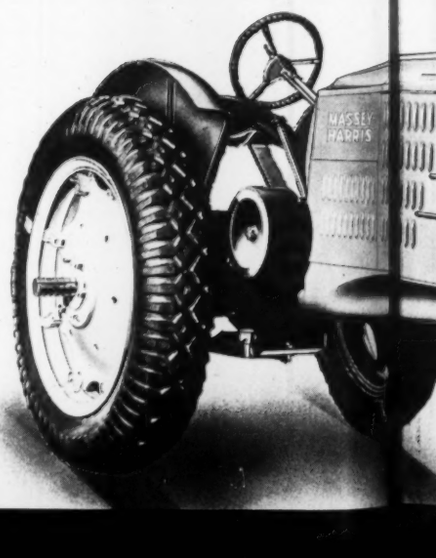
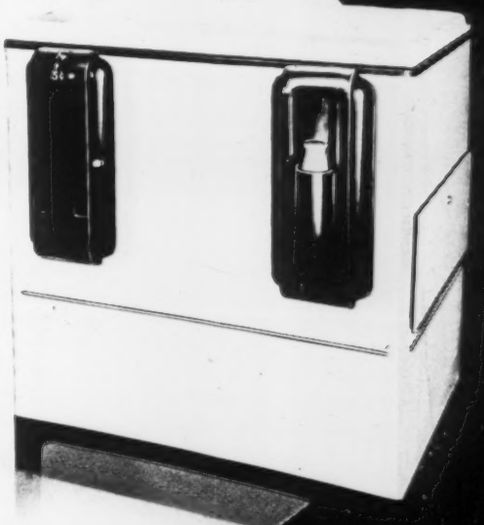


Feature of the Massey-Harris model 101 tractor, right, is its self-starter, installed as standard equipment. The Chrysler heavy duty industrial engine is designed to operate at 2800 to 3600 revolutions per minute, but in the "101" it operates at only 1500 on drawbar work, 1800 on belt work and road speed. "Streamlined" design of the hood gives the tractor a snappy appearance



Operation of the Kalva milk vending machine, right, is entirely automatic. Interior parts are either hot-dip galvanized or cadmium plated, affording protection against corrosion or rust. All sprockets and ejector door mechanisms are ball bearing equipped. Drive mechanism is a standard 1/8-horsepower motor with a 40 to 1 reduction gear. Exterior walls of the cabinet are of 20-gage automotive body steel, inner cabinet of 16-gage



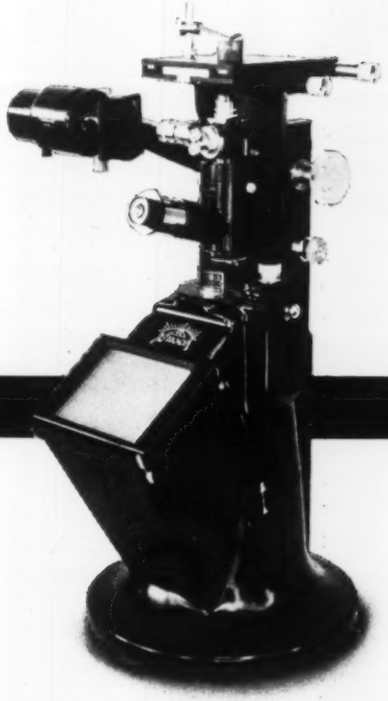
n Features w Machines

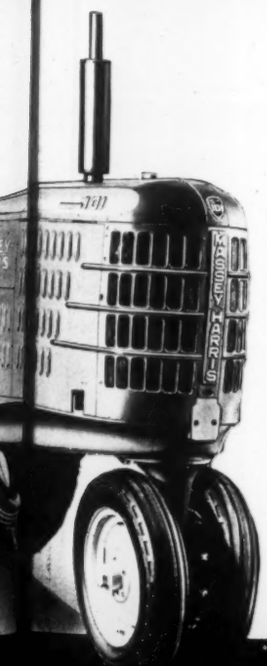
resen on of Recent Ma- the ndpoint of Design

machi ng see page 78)

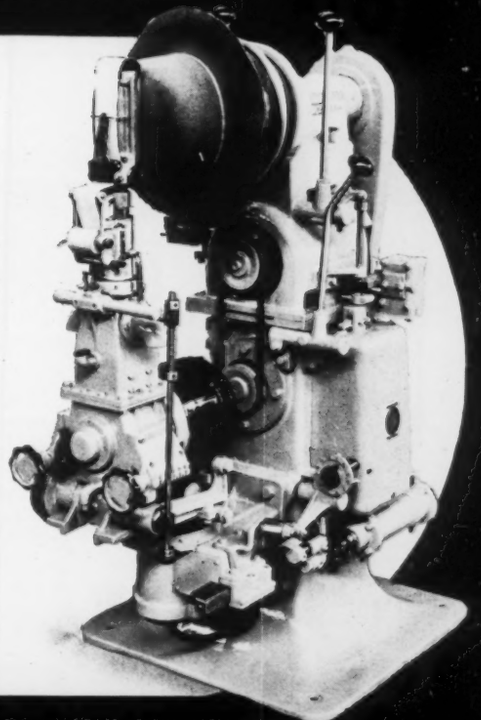
Rigid stability and ease of cleaning mark the design of the Enterprise electric meat chopper, right. It has a silver-satin finish on a cast-aluminum housing, with a cutting group and meat tray of polished chromium. The helical-cut, steel gears need little attention if kept properly lubricated

A urgical microscope and otographic camera are bled into one perma aligned unit, the Bus etaphot, right. Instea bellows, the camera is ped with a device whi hanges the magnifica of any eyepiece optical the turn of a dial. Stag the microscope is e inverted type





Surfaces subject to wear on the Doran hat crown finishing machine, right, are sprayed with high carbon steel to a thickness of .015 or .020-inch. This sprayed-on steel, when ground, makes an excellent bearing surface for high speed production. Use of Dowmetal for most of the reciprocating parts of the sandpaper tool makes for lightness. Feed of the tool across the surface of the hat crown is hydraulically operated



Don't Overlook Rapid Strides Made in Application of Hydraulics

RIVALING the electrification of machines and the use of welding, in the spotlight of design, hydraulics is staging another thrust forward—stronger than ever! Time was when hydraulic operation was identified almost solely with elevators and presses of various kinds. Later it became recognized by the machine tool field—among the larger industries—then by road machinery and equipment builders. Today its tentacles are so far-reaching that one has difficulty in naming more than a handful of specific classes of machines in which hydraulics plays no part.

Proof of this, aside from observation in the field and at machinery exhibitions, etc., is readily obtainable from perusal of the illustrated "center spread" appearing each month in MACHINE DESIGN. Selection of machines included in these pages is made from as wide a range as possible and it is a rare occurrence when among the eight or nine machines shown, two or more do not incorporate hydraulic operation of important mechanisms.

One of the primary considerations that undoubtedly is contributing to this current popularity of hydraulics is the eminently successful application to automobile braking. It will be remembered that during the first year or so after institution of this method many automobile drivers were skeptical, but the fact that all cars are now equipped with hydraulic brakes is convincing evidence of their reliability and general success. That hydraulics is destined to play an even more important part in design of cars in the not too distant future is clear from a reading of Mr. Wolf's automobile article in this issue. Perhaps we eventually will see, for instance, an extension of the use of the fluid flywheel, or as it is sometimes called "hydraulic coupling" to all classes of passenger cars.

Another factor significant of the trend is the increase in size and facilities of companies well established as manufacturers of hydraulic equipment and the entrance into this field of numerous organizations formed either to produce hydraulic units, or who have added the manufacture and sale of this type of machine part to their existing lines. Machine tool builders and press manufacturers have been quick to realize the potentialities of the rapidly-growing market and, in some of the few cases where they have been producing hydraulic equipment themselves for use on their own machines, have turned this into a commercial line for sale to other builders of various classes of machinery.

Several papers and discussions on hydraulic operation of machines are scheduled for the forthcoming meeting of the American Society of Mechanical Engineers in New York. MACHINE DESIGN proposes to continue to devote space to the subject by abstracting these or other papers and by presenting original contributions covering the march of progress in this field. It will amply repay engineers responsible for design to keep fully abreast of current and future developments.

Lighter, Simpler War Machines Needed*

By The Honorable Louis Johnson

Assistant Secretary of War

TODAY, industry serves the Army in many ways. It co-operates and supports the War Department plan of national defense and works wholeheartedly toward the realization of its industrial mobilization program.

For about 90 per cent of our munitions needs in an emergency, we must turn to civilian production. The Army definitely came to that conclusion shortly after the World war and as soon as industry learned that fact, its leaders volunteered to co-operate.

To determine the capacity and the ability of American industry to produce the necessary munitions in time of war, the Army decided to make a complete survey of all of our principal plants and factories. Our officers inspected more than 20,000 plants. Owners, managers, foremen and engineers helped us at every step. Where information was meager or inadequate, many of the factories assigned their own officials, on their own time and with their own money, to do the research work necessary to assist the Army in the survey of their establishments.

In the discussions between the production engineers and the Army officers, questions involving industrial and business secrets often arose but information was never denied. That trust has never been violated.

As a result of these surveys, we feel that with proper education industry can carry a major war load and take care of our civilian as well as our military needs in time of emergency. As a result of these studies, we have earmarked 10,000 plants for war production. We have informed their managers and their proprietors as to the tasks to be imposed upon them in the event of war. All of them have expressed their ability to assume the task. All are eager to co-operate with the War Department in this important job.

Not only in our surveys but in the improvement of our designs of technical munitions and in the standardization of component parts for mass production, industry materially has aided the Army. Specifications and drawings of the War Department submitted to manufacturing plants have often been returned with constructive criticism and valuable suggestions.

There is a tendency manifest among military designers of arms, ammunition and accessories to develop complicated machines not readily adaptable for mass production. Against such a trend, we must continually guard. We should strive to develop simple weapons, whose production would present little or no problems for industry. I realize that some degree of complexity in military weapons is inescapable but, frankly, I believe that there are too many complicated weapons in the Army.

I am inclined to the general view that what private industry can make should be the deciding factor of what the Army can use and what private industry makes best is exactly what the Army must use.

* *From an address at the national fall meeting, ASME.*

Men of Machines

KARL M. WISE

AS DIRECTOR of engineering, Bendix Aviation Corp., Karl M. Wise, formerly assistant director of engineering, will put to good use his engineering experience gained primarily from the automotive industry. He joined the company in 1934 as technical advisor and vice president of one of its subsidiaries.

A graduate of the engineering school, University of Michigan in 1909, his early work was in drafting and design, later in metallurgy and research. Resigning as consulting engineer and chief metallurgist of Studebaker, he joined Crucible Steel Co. of America as works manager, subsequently becoming assistant to vice president and chief metallurgist. In 1916 he was named assistant chief engineer of Chalmers Motor Car Co. After private practice during the war, he returned to Studebaker on research, and later until 1934, was executive engineer in charge of design.

• • •

H. C. BOARDMAN

ELECTION of H. C. Boardman, research engineer of Chicago Bridge & Iron Co., as president of American Welding Society has been announced.

Born in Plainfield, Ill., Mr. Boardman graduated from the University of Illinois in 1910 with a Bachelor of Science degree. He then entered the employ of the company with which he is now associated as draftsman, later becoming chief draftsman and designing engineer. During the war he served successively as corporal, second lieutenant, captain, commander, instructor and major of field artillery. After a period in the automotive field he joined the International Filter Co. as designer and later became superintendent of construction. In 1924 he was appointed instructor in the college of engineering, University of Illinois, and two years later returned to the Chicago Bridge & Iron Co., as research engineer, his present position.

• • •

FLOYD T. HAGUE

FLOYD T. HAGUE, formerly manager of the direct-current engineering department of Westinghouse Electric & Mfg. Co., East Pittsburgh works, has been named manager of engineering of the steam division at the South Philadelphia works of the company.

After being graduated from Western University of Pennsylvania in 1911, Mr. Hague joined the engineering department of the Westinghouse company, where upon completion of an apprenticeship course he became associated with the late B. J. Lamme, then chief engineer. As assistant to Mr. Lamme, he received broad design experience in all types of rotating electrical machines.

In 1925, he was placed in charge of direct-current machines and synchronous converters, this after obtaining experience in the various design

sections of the power engineering department. Later his duties were extended to cover automobile parking elevators, induction regulators, industrial furnaces and various special types of machines. Mr. Hague has been responsible for the development of a design system, applicable to many lines of products, whereby quantity production of machines of various sizes may be achieved with a small variety of standard parts.

♦ ♦ ♦

C. W. BRIGGS has been made technical engineer for the Steel Founders Society of America, Cleveland, and will, among other projects, initiate the development of a cast steel data book. Mr. Briggs was formerly physical metallurgist for the Naval Research Laboratory, Washington.

♦ ♦ ♦

EDWIN R. RATH, for the past four years head of the Department of Industrial Research of New Hampshire university, rendering consulting engineering service to manufacturers of that state, has joined Power Transmission Council Inc. as chief engineer.

♦ ♦ ♦

DR. FRANK BALDWIN JEWETT has been awarded the 1939 John Fritz Gold medal for "vision and leadership in science, and for notable achievement in the furtherance of industrial research and development in communication." Dr. Jewett is vice president of the American Telephone & Telegraph Co., and president of the Bell Telephone Laboratories.

♦ ♦ ♦

J. C. HODGE and C. R. SADLER have received the J. F. Lincoln award, which this year has been made in duplicate to co-authors of the prize-winning treatise. Both Dr. Hodge and Mr. Sadler are associated with Babcock & Wilcox Co.

♦ ♦ ♦

CLARK WALES, recently appointed assistant general manager of Algoma Steel Co., has been elected president of the Association of Iron and Steel Engineers. In MACHINE DESIGN for November, 1937 there appeared a photograph and a more complete coverage of the career of Mr. Wales.

♦ ♦ ♦

J. C. BARNABY, former manager of the oil and gas engine application division at Buffalo of the Worthington Pump & Machinery Corp., Harrison, N. J., has been placed in charge of special engineering work in connection with engine research and design.

♦ ♦ ♦

DONALD DESKEY, industrial designer, has been appointed head of a department of industrial design at the New York University School of Architectural and Allied Arts.

♦ ♦ ♦

DR. RICHARD M. WICK, who was associated with the national bureau of standards since 1929, has joined the staff of the development and research department of Bethlehem Steel Co. For several years Dr. Wick was consultant on projection and surface treatment of metals for the bureau of aeronautics, navy department, principally at the naval aircraft factory in Philadelphia.

♦ ♦ ♦

JOHN B. HAYWARD has been named supervisor of patent developments of International Business Machines Corp., with headquarters in the IBM World Headquarters building, New York. Mr. Hayward formerly was connected with the patent department.

♦ ♦ ♦

GUY D. BARNETT, formerly head of the body-design department of Chrysler Corp., has been appointed Dodge body engineer.

♦ ♦ ♦

MAYSON WHITE TORBET, formerly chief engineer of United Shipyards Inc., has been appointed chief engineer of Davis Engineering Corp.

♦ ♦ ♦

GEORGE M. VERITY recently received an honorary degree of doctor of engineering at the Stevens Institute of Technology. Mr. Verity is founder, president and now chairman of the American Rolling Mill Co.

Obituaries

Prof. J. D. Hoffman, a well-known figure in the field of heating and ventilating, died unexpectedly at his home in West Lafayette, Ind. After receiving his degree from Purdue, Prof. Hoffman worked for Buckeye Engine Co. In 1890 he joined the staff of Purdue, serving as instructor and assistant professor of practical mechanics, then machine design and later as associate professor of engineering design until 1911. He then became associated with the college of engineering at the University of Nebraska, as professor of mechanical engineering and practical mechanics. Returning again to Purdue as professor of mechanical engineering in 1918 he headed the department of practical mechanics until his retirement in January, 1930—after completing 49 years as teacher of engineering subjects.

♦ ♦ ♦

Charles Edgar Duryea, pioneer motor manufacturer and inventor of America's first gasoline automobile, died at his home in Philadelphia. Mr. Duryea's first car was given its initial test at Springfield, Mass., in 1892.

♦ ♦ ♦

B. A. Linderman, head of Linderman Devices Inc., died at the age of 67. He was a well-known inventor of special woodworking machinery, and during the war was engaged in the manufacture of several types of gun mounts.

NOTEWORTHY PATENTS

APPLICATION of the two-stroke cycle to internal combustion engines of balanced radial type is the object of the design depicted by *Fig.* 1. This is covered by patent No. 2,088,863, issued to William McClelland of Rock Ferry, Birkenhead, England.

The design involves an engine with rotating crankshaft, and with at least two power cylinders and at least two pump cylinders—all mounted on the crank case within which the crankshaft revolves. The cylinders must be disposed around the crankshaft so that

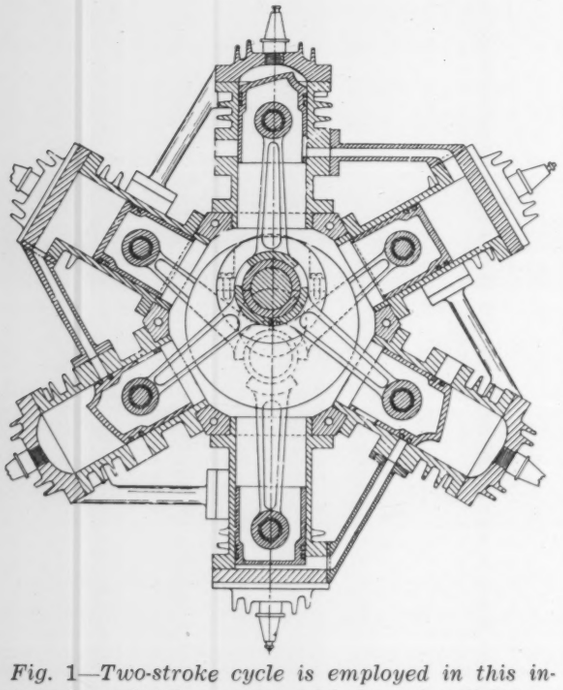


Fig. 1—*Two-stroke cycle is employed in this internal combustion engine of balanced radial type*

each power piston has a balancing pump piston as nearly as possible diametrically opposite to it and moving 180 degrees out of phase therewith.

Thereby the power piston and the pump piston are always at the same distance from the crankshaft axis. Each pump piston then serves to charge the cylinder of a neighboring power piston with the combustible mixture by which the engine is driven.

Preferable each power piston is provided with a skirt having an inlet port which can be brought into register with an inlet port in the power cylinder. Thereby a piston in the neighboring pump cylinder connected to the power cylinder inlet port can be used to draw a charge through the ports in the skirt and power cylinder into the neighboring pump cylinder. It then can expel this charge into the combustion chamber of the power cylinder by way of the power cylinder inlet port.

The port in the skirt of the power piston can be made of such size that the neighboring pump piston is drawing a charge into its cylinder during practically its entire suction stroke. This insures that an adequate charge can be expelled into the power cylinder combustion chamber during reverse movement of the neighboring pump piston.

This design is particularly suited to a radial engine with six power cylinders and six pump cylinders arranged in two banks of three power cylinders and three pump cylinders each. Power and pump cylinders are alternately disposed around the crankcase, all the power cylinders being connected to one crank pin and the three pump pistons of one bank and the three pump pistons of the other bank being respectively connected to crank pins located on either side of the crank pin of the power pistons. This insures good timing, no crank case compression, and a short, stiff crankshaft, together with good balancing of the engine.

Chute Deflects Slugs

DEVELOPMENT of coin-operated devices almost invariably brings up the problem of prevention of operation through use of slugs. A vast amount of thought and ingenuity has been expended upon this subject and a wide variety of devices—mechanical, electrical, pneumatic and magnetic—have been devised. The one shown by *Fig.* 2 has been invented by Theodore Bibicos of Cleveland, O., with the needs of telephone pay stations particularly in mind. His design is covered by patent No. 2,118,425.

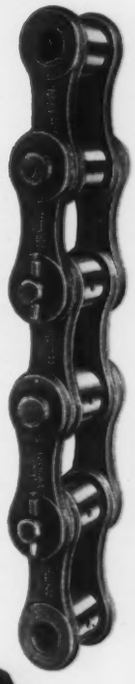
The illustration shows two views of the Bibicos invention, at the left being the chute with cover removed, and at the right an end view in section. In operation, a small slug dropped in the coin slot will roll down the initial passage way until it strikes a buffer which causes it to fall outward through an

2 MILES HIGH, 2 MILES DEEP, OR IN HEAVY TRAFFIC...

YOU'RE MONEY AHEAD

BY USING

NICKEL ALLOY STEELS



BORING 2 MILES down through rock puts tremendous stresses upon oil well machinery. To shoulder such loads the Baldwin-Duckworth Chain Corp., Springfield, Mass., has developed what is said to be the strongest chain of its type ever built. With links and pins of 1.50-2.00% Nickel alloy steel, tests show a minimum ultimate strength of 185,000 lbs. Baldwin-Duckworth also builds conveyor chains from "18-8" Nickel-chromium stainless steel to resist corrosion and withstand elevated temperatures. By minimizing causes of repairs and replacements, Nickel saves you money.

GIVING WINGS to business—every plane built relies on Nickel alloy steels to assure great strength without excess weight. Wherever metals carry high loads or transmit heavy power loads, there Nickel is needed. Important also to the aircraft industry is the increasing application of corrosion resisting steels containing 8% Nickel for wings, tail assemblies, floats and other structural components which must be strong, durable, light in weight, and economical in maintenance.

LIGHTENING HAULING COSTS through Manhattan's congested traffic, a fleet of these new Gar Wood self-loading, self-dumping trucks on GMC chassis is now saving money for New York taxpayers. These lighter, stronger bodies are of Yoloy, a high tensile Nickel-copper steel produced by The Youngstown Sheet & Tube Co. In addition to high strength/weight ratio, Yoloy Nickel alloy steel provides resistance to both abrasion and corrosion. Have you asked for information about the newest uses for Nickel in your industry?

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL ST., NEW YORK, N. Y.

opening into the slug receptacle, the one at right.

A large slug or a heavy slug, being greater in circumference than the one just mentioned, will get by the first orifice but upon traveling around the bend will strike a spring which retards its downward speed. Either one in passing through the aperture beneath the projection strikes a pair of gates. The lighter slug does not tip the gates enough to open them fully but its impact does cause them to open slightly. Weighted ends then return these gates to their original position. This pushes the slug upward and outward causing it to roll along the top surface of the second gate, thus diverting it into the slug receptacle. The other slug, being heavier, does open the gates, thus getting into the coin guide below them. Thereupon it strikes another spring which retards its velocity. It then drops onto another pair of gates which are opened by its weight and so drop it into the slug receptacle.

A genuine coin, however, will roll over these gates without opening them and safely reaches the coin receptacle at left side of bottom of the tortuous chute.

Simplified Electrical Control

MILLING planers of electrical type involve use of several motors, which drive the various elements of these heavy duty machines. To afford greater flexibility of control of these multiple motors; to reduce to the minimum the number of pilot switches and auxiliary control devices required; to simplify operation; to provide safety and ease of control; and to make possible quick change from planing to milling—these are important objectives sought by John E. Doran of The G. A. Gray Co., Cincinnati, in his recent invention covered by patent No. 2,079,735.

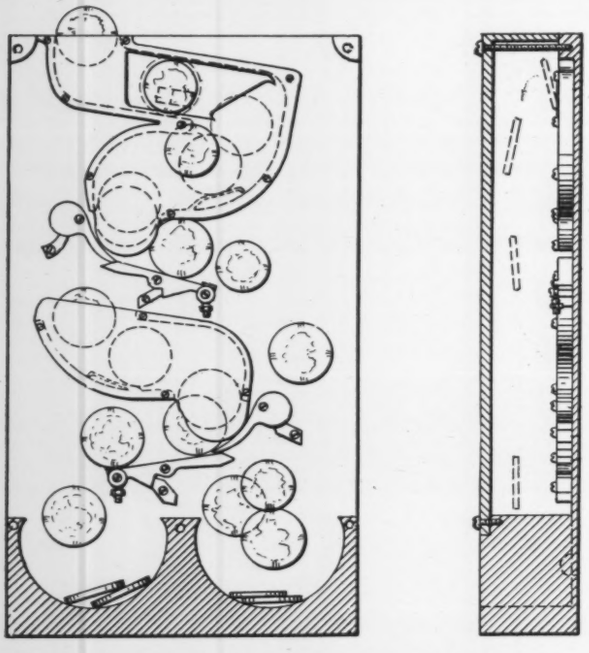


Fig. 2—Adapted to telephone pay stations, tortuous coin chute prevents operations by slugs

A milling planer is similar to an ordinary planer in that it may be either of double housing or of open-side type, but it is provided with one or more revolving spindle milling heads in addition to its one or more planing heads. Suitable driving and feeding mechanism is built in, which enables work to be milled and planed at the same setting. This requires that the table be reciprocated at suitable cutting speed by power when the machine is used for planing; also that the table or the milling heads be moved at suitable feeding speeds by power when the work is being milled.

For setting up work for planing or milling it is desirable to move the work table forward or backward by power at a speed suitable for rapid traverse. When positioning work or milling cutters and for setting up for boring and drilling operations, it is desirable to move the table or milling head very slowly into place by power so as to position the work or head with great accuracy.

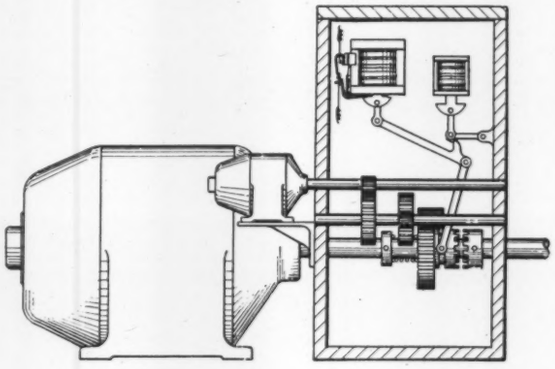


Fig. 3—Solenoids actuate automatic clutch element in electrically controlled planer

Mr. Doran has simplified things by using "pilot members"—pilot switches, relays, interlocks, safety contact members and selectors. A "pilot member" is any control device (for instance, an electric switch) used in connection with a machine and operated manually or by movements of the machine or of parts thereof and adapted to operate control devices which affect operation of a source of mechanical power which in turn actuates the machine.

While in his patent paper Mr. Doran illustrates and describes with clarity and completeness his whole interesting system, space here limits us to a glance at only one of its many ingenious features. *Fig.* 3 shows the main drive motor and the feed motor, together with an arrangement for the solenoid control of the mechanical clutch on the main drive shaft. Pull exerted by the larger of the two solenoids declutches the drive and a latch keeps it declutched until the second and smaller solenoid comes into action to lift the latch—whereupon the clutch is reengaged by spring pressure.

American Seamless Flexible Metal Tubing

...Industry's Super Tubing

THE ideal flexible connector for misaligned or moving parts... for isolating vibration... for the dependable conveyance under high pressure of air, water, oil, steam or fuel. That's *American Seamless*—all metal, with no joints, welds, laps, seams or packing of any kind. The toughest tubing you can buy!

Write us about your connector problems. Our engineering department has a wealth of information on the use of *American Seamless* on all types of equipment.

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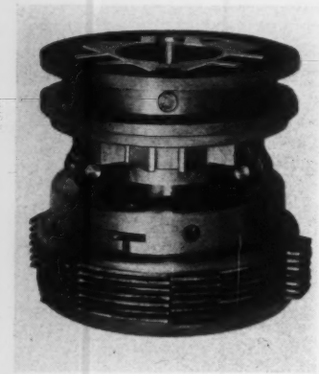
NEW Materials and Parts

Clutch for Limited-Space Use

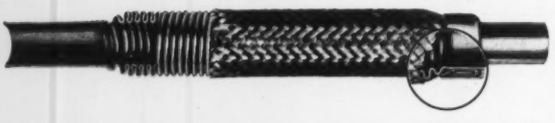
A NEW model of multiple disk-type clutch, designed for machine tool and other installations where space is limited, has recently been put on the market by Twin Disc Clutch Co., Racine, Wis. Known as model MT, this new clutch has a greatly simplified design. Because of its action, it has an easy, smooth engagement and release with less engaging pressure. The model MT clutch is available in nine different sizes, ranging from 3-inch in diameter to 8-inch, in single or duplex units, to run dry or in oil. Minute adjustments on all sizes can be made from a single point to give maximum capacity from minimum lever pressure.



Multiple disk-type clutch for machine tool applications is available in nine different sizes, on which small adjustments can be made to give maximum capacity

Vibration Absorber Brought Out

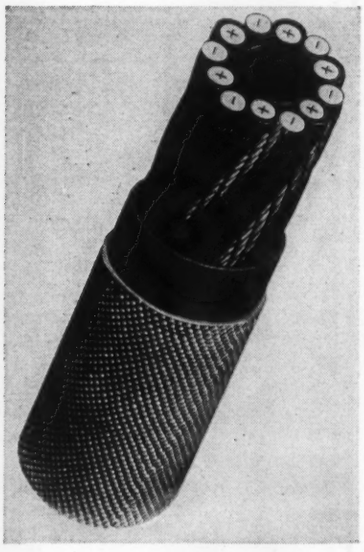
VIBRATION absorber of special design just brought out by Packless Metal Products Corp., Long Island City, N. Y., is used for eliminating vibration, deadening noise, preventing pipe breakage and leak-proofing lines. It is made from seamless bronze tubing drawn into a helical flexible tube. Plain straight end extensions are provided to slip over standard piping or to make up to standard fittings. Notable feature is the one-piece construction of the absorber tube. No welding is employed. Another improvement is the permanent double-clamping of the high tensile bronze braid casing by means of a metal ring snugly encircling the tube and gripping the braid end, and the soldered ferrule which envelops the ring and braid end completely and tightly. These vibration absorbers come in 14 sizes, ranging from ¼ to 6-inch internal diameter.



One-piece construction of seamless bronze tubing gives new vibration absorber capacity to prevent pipe breakage and deaden noise

Welding Cable Carries More Current

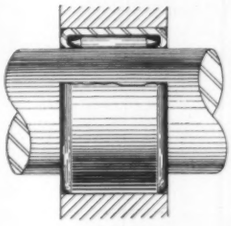
KICKLESS welding cable, a watercooled electrical connection between the secondary taps of a welder transformer and a portable welder gun, has been announced by Clark Controller Co., Cleveland. It consists of a central rubber core around which are helically wound flexible, tinned copper cables. For alternate polarity these cables are separated by a corrugated live rubber spacer, the whole enclosed in a flexible, wire and woven fabric rubber tube. This construction is said to permit passage of 50 per cent more



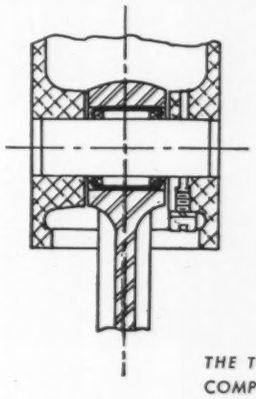
Passage of 50 per cent increased welding current is said to be possible with new kickless welding cable

TORRINGTON NEEDLE BEARING

DESIGN AND SERVICE FEATURES

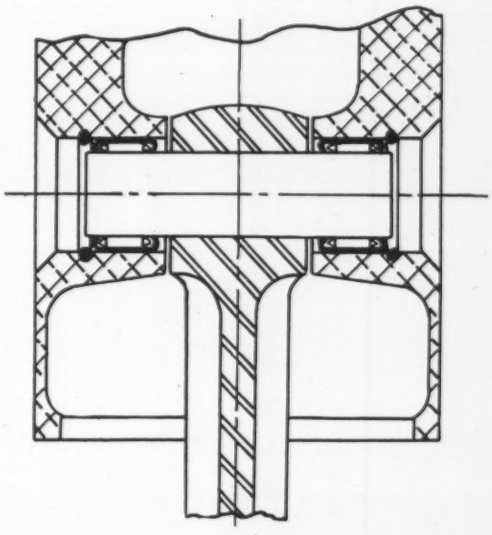


BEARING DESIGN SIMPLIFIES PRODUCT ASSEMBLY



THE TORRINGTON NEEDLE BEARING IN COMPRESSOR WRIST PINS — A TYPICAL ILLUSTRATION OF ITS COMPACT DESIGN

Compact Unit Easily Installed



THE TORRINGTON NEEDLE BEARING is a single unit, compact and complete. The hardened retaining shell which holds the needles forms the outer race; the shaft is hardened to form the inner race. The unit is quickly and easily pressed into place, saving time in the assembly of such mechanisms as the compressor wrist pins illustrated.

The hardened retaining shell, made with turned-in lips, serves also as a reservoir for the lubricant. The needles rotate constantly in a bath of oil or grease, and the quantity held by the shell is sufficient for long periods of operation without renewal.

High Unit Capacity

The Needle Bearing's many linear inches of contact give high radial capacity in proportion to the size of the bearing. Small sizes can be used to take severe loads, effecting marked economies in both space and cost. Long axially and small radially, the bearing can be mounted in an extremely simple housing design. Economies in bearing size, housing construction, and unit cost of the bearing combine to provide a highly inexpensive means of securing the advantages of anti-friction construction. Cost and space requirements are comparable with those of a simple bronze bushing.

The experience of the Torrington Engineering Department is at your disposal in laying out applications of this bearing to your products. Further information is given in the Torrington Needle Bearing Catalog, available on request. Write for Catalog No. 9.

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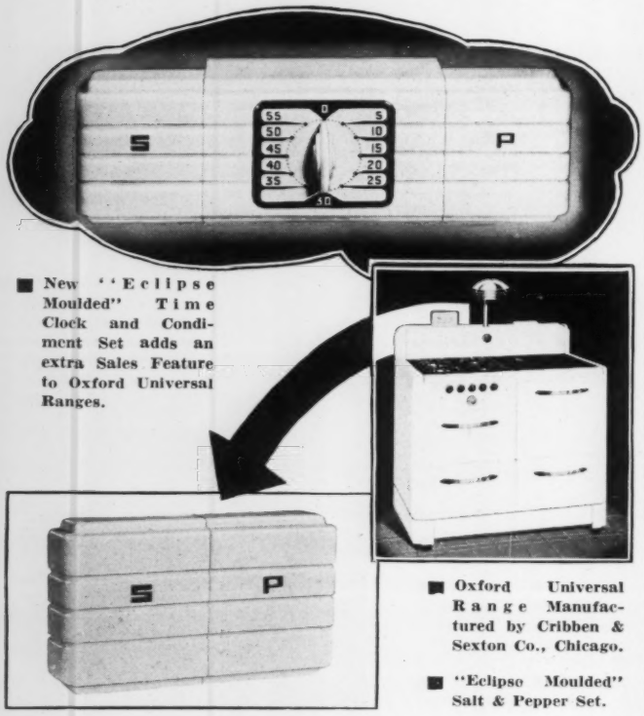
Makers of Ball and Needle Bearings
Branch Offices in all Principal Cities

TORRINGTON
NEEDLE BEARING

ECLIPSE MOULDED PRODUCTS

In the Kitchen . .



■ New "Eclipse Moulded" Time Clock and Condiment Set adds an extra Sales Feature to Oxford Universal Ranges.

■ Oxford Universal Range Manufactured by Cribben & Sexton Co., Chicago.

■ "Eclipse Moulded" Salt & Pepper Set.

An interesting feature of the set is a specially designed revolving filler opening for quick and easy filling.

Here is one example of Eclipse's designing and moulding service to manufacturers of Kitchen Appliances. . . Adding the "Extras" in modern accessories that provide powerful Sales Appeal.

Moulding the intricate and difficult shapes, affording new savings, offering new design-beauty to finished products of many kinds has been our specialty for many years.

Eclipse Moulded Products are saving hundreds of dollars for manufacturers in every industry—besides improving their products, in appearance and utility.

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■ **MOULDERS OF**

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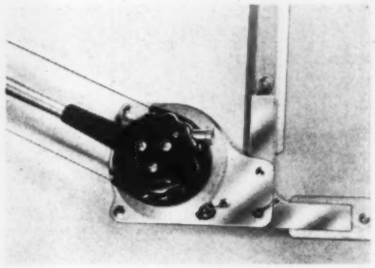
Eclipse Designers, Engineers, Craftsmen are trained in moulding ALL PLASTICS. They know which of the many available modern plastic materials will most profitably serve your needs. Call upon Eclipse for an UNBIASED recommendation.

welding current than normally. Uniform amperage is delivered at all times.

Touch-Control Drafting Machine

BRINGING new speed, accuracy and smoothness to the drafting process, a drafting machine of unusual precision, known as the touch-control drafter, has been brought out by Charles Bruning Co., 100 Reade street, New York. The method of controlling the protractor head assures utmost responsiveness and eliminates all fumbling or other waste motion. The touch control button is located on the protractor head and a touch of the hand on the button releases the



Touch-control button on the protractor head of this drafting machine permits the head to be rotated freely

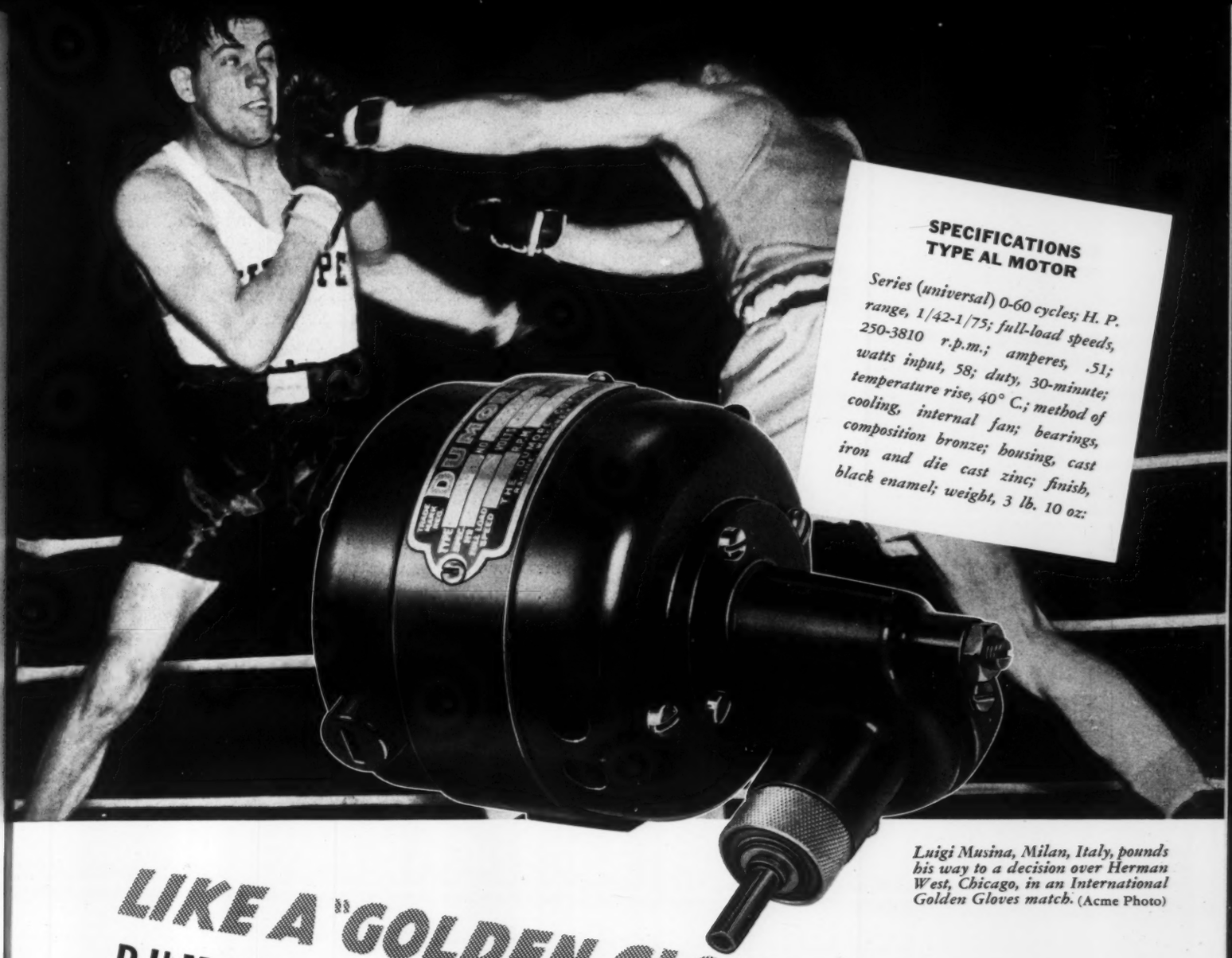
head, allowing it to rotate freely to the desired setting. Simply lifting the thumb locks the head positively at the desired automatic index stop. The full circle protractor is graduated throughout in degrees and numbered in each quadrant from 0 to 90 degrees. Automatic indexing stops are provided at 0, 30, 45, 60 and 90 degrees in each of the four quadrants. The double vernier reads to five minutes.

Remote Systems Simplify Air Control

REMOTE air-operating system to simplify the control of air-operated equipment have been developed by Logansport Machine Inc., Logansport,

Remote control for air-operated equipment is possible with new systems suitable for practically any kind of control of one or more cylinders

Ind. They make possible remote control for air devices, permit operation from conveniently located operating stations, and are suitable for practically any kind



SPECIFICATIONS
TYPE AL MOTOR

Series (universal) 0-60 cycles; H. P. range, 1/42-1/75; full-load speeds, 250-3810 r.p.m.; amperes, .51; watts input, 58; duty, 30-minute; temperature rise, 40° C.; method of cooling, internal fan; bearings, composition bronze; housing, cast iron and die cast zinc; finish, black enamel; weight, 3 lb. 10 oz.

Luigi Musina, Milan, Italy, pounds his way to a decision over Herman West, Chicago, in an International Golden Gloves match. (Acme Photo)

LIKE A "GOLDEN GLOVES" CHAMPION

DUMORE GIVES YOU MORE FOR YOUR MONEY

In choosing a motor to power your product, remember this: You will get out of a motor just what has gone into it. Into every Dumore unit goes the most exacting production practice known to modern engineering . . . proved and perfected by 25 years of laboratory studies and field experience.

Small wonder that every Dumore has the guts to deliver smooth, straight-forward, two-fisted power . . . the kind of power to sock tough jobs square on the jaw . . . with plenty of stamina in reserve to purr on for hours longer.

Just what are these manufacturing methods that give a Dumore many more hours of power punch?

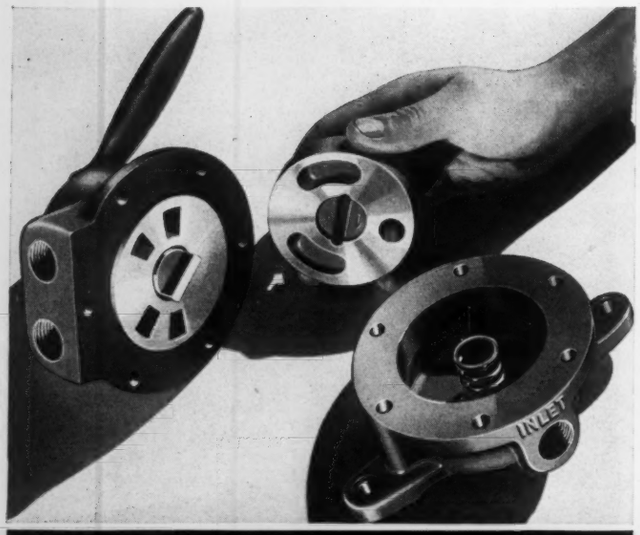
(1) Armatures dynamically balanced to *eliminate vibration,* (2) commutator leads swaged by special Dumore process to assure 100% *electrical contact,* (3) commutators ground concentric with bearings for *longer brush life,* (4) armature windings expanded then *double-sealed,* to *prevent centrifugal* "breathing", (5) motors inspected 5 *times* in manufacture; run-in to *seat brushes properly.*

For real champion performance put a Dumore behind your product. They are of the universal (AC-DC) type . . . 1/500th to 2/3 h. p. . . . 0 to 60 cycles . . . with tailor-made parts for special applications. Feel free to call on Dumore engineers for counsel without obligation.

THE DUMORE COMPANY - DEPT. 128-L. RACINE, WIS.

DUMORE MOTORS

FOR *Extra Power Hours*



This Simple

"PACK-LESS"

DESIGN

of Hannifin disc-type air valves gives positive control, and smooth, easy handling of air operated equipment. The bronze disc is ground and lapped to form a perfect seal with the seat, which is similarly finished. Wear is negligible. There is no packing, and consequently no leakage or packing maintenance troubles. For accurate control and economical use of air power, specify Hannifin "Pack-less" Air Control Valves.

Made in 3-way and 4-way types, hand and foot operated, spring return, heavy duty rotary, and electric remote control types, for control of single- or double-acting cylinders. Write for bulletin 34-MD with complete specifications of all types.

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Engineers • Designers • Manufacturers • Pneumatic and Hydraulic Production Tool Equipment

HANNIFIN

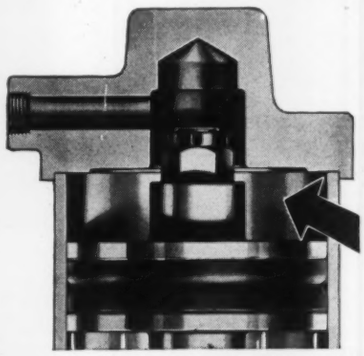
"Pack-less"

AIR CONTROL VALVES

of manual, semiautomatic, automatic, interlocking or sequence control of one or more cylinders. Master control valves are installed close to the cylinder, resulting in short pipe connections and a minimum of friction losses. They are operated by either direct-connected bleeder valves, pressure-operated bleeders, solenoid bleeders, or a combination of these types. Operating stations are placed in any convenient location, within easy reach of the operator. A new bulletin No. 370 gives full description, specifications and dimensions of the different models of these air operating systems.

Non-Adjustable Cushion Air Cylinder

A COMPLETE line of Nopak cushioned air cylinders with non-adjustable cushion-heads has been announced by the Galland-Henning Mfg. Co., Milwaukee. Cylinder life is said to be greatly prolonged by this new built-in air cushion. At the same time, it assures smooth, efficient operation and low maintenance



Cushioned air cylinders with non-adjustable cushion-heads are said to have prolonged life and to assure smooth operation of air-powered equipment

cost for all air-powered equipment. However, Nopak air cylinders with *adjustable* cushion-heads are recommended by the manufacturer for those applications where accurate control of "cushioning" is required at the end of the piston stroke. A complete new bulletin giving full details of both the new non-adjustable type of cushioned air cylinders and the adjustable type is now ready for distribution.

Material Combines Plastic and Wood

DURAWOOD, a new material combining Micarta and natural woods, is being manufactured by the Westinghouse Electric & Mfg. Co., East Pittsburgh. It is tough, long-wearing and possesses the durability and hardness of Micarta and the varied beauty of genuine wood designs. Durawood is not an imitation. The natural wood is impregnated and treated so that its glass-like surface is impervious to liquids of all kinds, yet it will not chip, break or crack. Furnished in sheets 48 x 96 inches, the material can be cut with an ordinary carpenter's saw to any desired specifica-

"Here it is 2 x 2½ x 3½"

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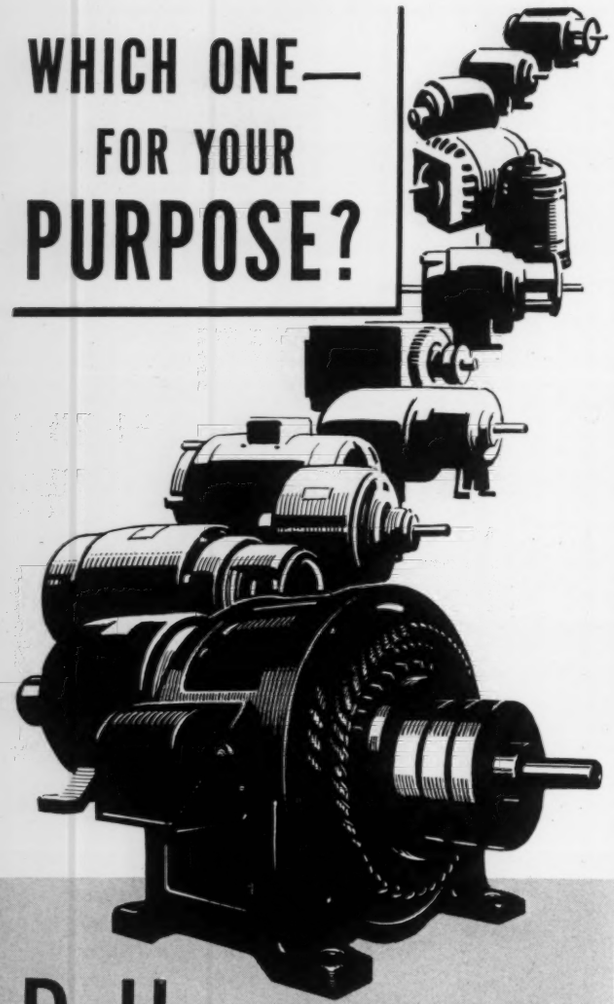
WHICH ONE—
FOR YOUR
PURPOSE?



P&H HIGH EFFICIENCY, ELECTRIC MOTORS

If your product is to deliver reliable service under all conditions, it deserves the proper motor, specifically suited to the work it does. Perhaps you, like many other manufacturers, will find the higher power factor and dependable operation of P&H Motors ideally suited to your own purposes. P&H high efficiency electric motors are built in a wide variety of sizes and types, to meet practically any requirement. If you have a special application problem, perhaps we can help you solve it. Why not write us? The Harnischfeger Corporation, 4556 W. National Avenue, Milwaukee, Wis.

Convertible slip-ring and squirrel-cage motors up to 250 h. p. capacity. Literature on request.

HARNISCHFEGER CORPORATION
MOTORS • HOISTS • WELDING ELECTRODES P&H ARC WELDERS • EXCAVATORS • ELECTRIC CRANES

tion, or quickly drilled for attaching. It does not require resurfacing, and will not warp or spring when properly applied.

Add Automatic Control to Motodrive

MECHANICAL automatic control has been developed to increase the utility of the Motodrive manufactured by the Reeves Pulley Co., Columbus, Ind. This control provides entirely automatic speed regulation of the drive to make possible synchroniza-

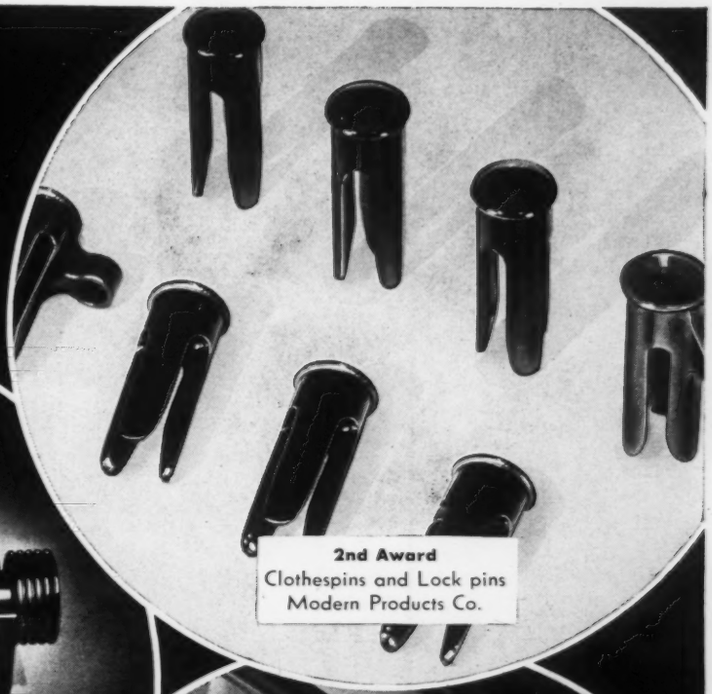
Automatic speed regulation of the Motodrive makes possible synchonization of different machines

tion of different machines and separate sections of a single machine. Other advantages include maintenance of constant tension and uniform peripheral winding speeds; maintenance of uniform pressure, weight, liquid level, temperature and other variable elements. On the motorshaft of the Motodrive is a cover plate, including a lever bracket and extended lever which may be attached by cable or chain, or direct to certain parts from which indication of required speeds can be taken. Movement of the lever is transmitted to the speed-changing mechanism. The control is available for all five sizes of the Motodrive, both horizontal and vertical designs.

Gasket Embodies Different Principle

EMBODYING what is claimed to be a basic improvement in the principle of gasket-making, a new Thiokol-treated gasket has just been announced by Felt Products Mfg. Co., Chicago. This new gasket, identified as Fel-Seal, is rubber-like and has permanent resiliency. It is impervious to water, oil and other penetrating liquids. It does not permit seepage or capillary action. Fel-Seal is treated *after* the gasket has been cut. This method encases the gasket in an impenetrable film and seals all exposed surfaces and edges, bolt edges, etc. The surface is flexible, conforming to uneven metal surfaces. Continued use under the engine's heat is said to improve the gasket's seal. Although Fel-Seal will withstand high

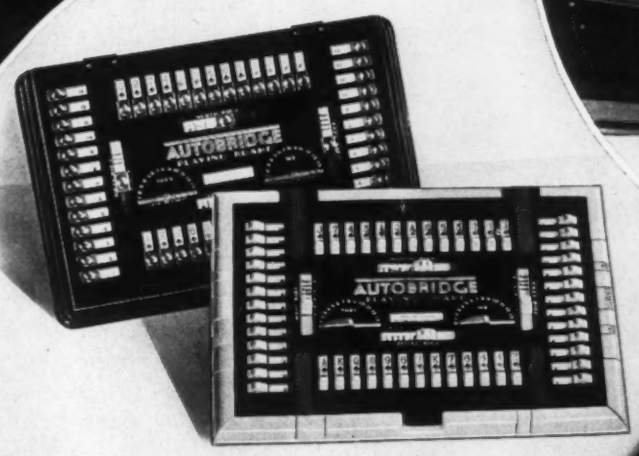
AWARDS
IN THE 1938 MODERN PLASTICS COMPETITION



2nd Award
Clothespins and Lock pins
Modern Products Co.

3rd Award
Waffle iron
Manning-Bowman & Co.

Honorable Mention
Subway lighting fixtures
Adams-Westlake Co.



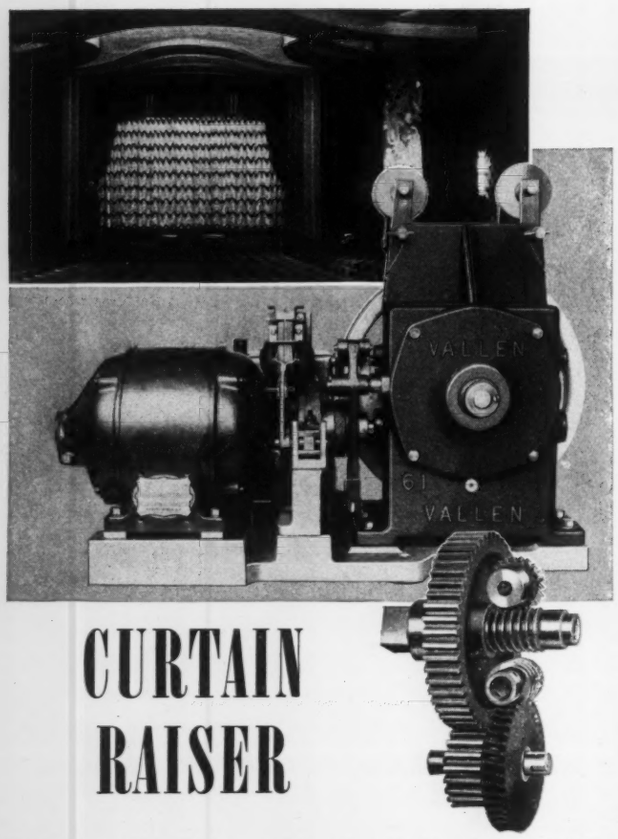
Honorable Mention
Autobridge boards
Autobridge, Inc.

Molded by the Plastics Department

GE

GENERAL ELECTRIC

PD-113



CURTAIN RAISER

● Long experienced in supplying theatrical equipment, Vallen, Inc., Akron, Ohio, know well the importance that theatre men place on the smooth, quiet operation of their curtains.

In designing the Aero Speed Curtain Control (shown above), the basic specifications of fast action, smoothness and quietness were of first importance. Sales competition dictated utmost simplicity and lowest possible cost. Space limitations held the entire operation to very narrow dimensions. Ohio Gear engineers, cooperating with Vallen engineers accomplished the desired result.

Curtain raising is but one of the many, varied applications of Ohio Gears. You, too, may find them valuable. Investigate Ohio Gears, Speed Reducers and Power Transmission Equipment for your own needs. A catalog will be mailed on your request.

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*Stocks carried.

OHIO GEARS

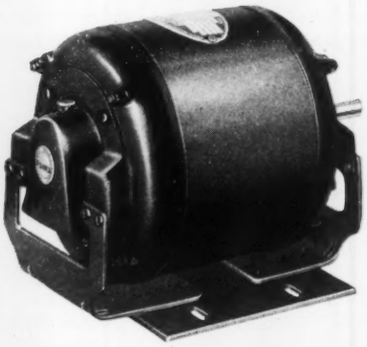
temperatures, it is not intended for such extremes as those generated in the manifold and cylinder head.

Plastic Suited to Injection Molding

A NEW plastic, especially suited to molding by injection methods, has been brought out by The Dow Chemical Co., Midland, Mich. Named Ethocel, it is based on ethyl cellulose. It is inherently resistant to degradation at molding temperatures, is readily heat-softened, possesses high flexibility and is comparable with a wide variety of plasticizers, resins and waxes. Ethocel plastic granules are available in a wide variety of colors ready for molding. Good gloss, surface hardness and shock resistance are properties of moldings made from Ethocel.

Rubber Motor Mounting Cuts Vibration

RESILIENT rubber mounting highlights a new ¼-horsepower motor just announced by the Brown-Brockmeyer Co. Inc., Dayton, O. Either the split phase, condenser type, or the repulsion-induction motor can be furnished with this rubber mounting. This construction is said to provide complete elimination of vibration and noise on the motor base



Rubber mounting on this new motor absorbs vibration, provides flexibility and takes care of torsional strains

because of effective use of an extra amount of live rubber in shear. Hence there is maximum absorption of vibration in the direction in which the vibration occurs. At the same time, there is proper movement of the motor in its mounting for correct alignment for drive purposes. The rubber mounting also takes care of the torsional strains imposed and prevents chatter and unnecessary swing of the motor in operation.

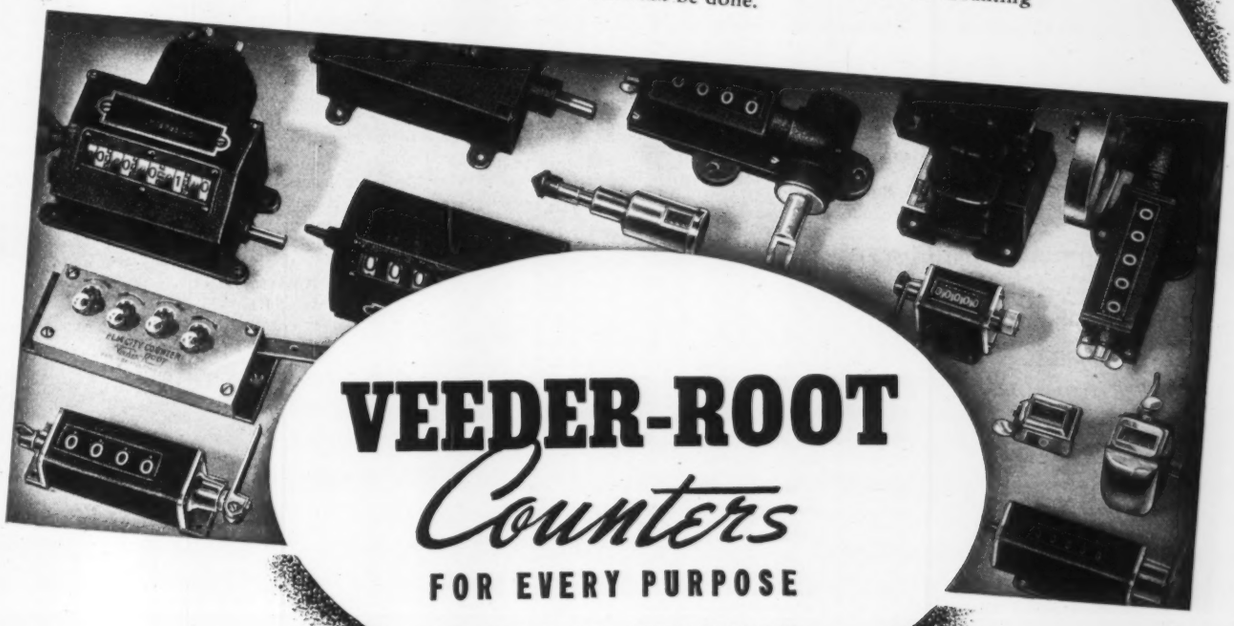
Sensitivity Features New Relay

HIGH sensitivity and rigid construction have been attained in this new type 500 relay announced by the Advance Electric Co., 1260 West Second street, Los Angeles. Positive, efficient operation on as little as three volts direct current is provided. Adjustable

Build in this INFORMATION BOOTH

Counting devices make instantly available valuable information on costs and production . . . machine output; lengths of materials and number of pieces produced; number of letters mailed; and innumerable other counting applications. This information forms the basis of cost control, wage scales, economy programs and waste elimination. To provide this information Veeder-Root designs and manufactures counting devices for hundreds of different machines — devices that count, measure or record lengths, volumes, pieces, starts, stops, revolutions, operations — counting devices that *even compute.*

Perhaps a Veeder-Root counting device built into your product will make it more valuable to the user and therefore more saleable. Find out. Write now for our free booklet "Counting Devices" that shows what has been done and what *can* be done.



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Extra Directories Available

Engineering departments are finding additional copies of MACHINE DESIGN's Directory of Materials invaluable. Since the appearance of the Sixth Edition, included in the October issue, the demand has been heavy. We suggest that you order your copy now—the supply is limited. Requests will be filled in order of their receipt.

This year's Directory, with earlier listings completely revised, supplemented and brought up-to-date, has four new sections: Stampings, Forgings, Die Castings and Custom Molders of Plastics. Designers of machinery upon whom responsibility for selection of materials falls, find these new sections and the information on ferrous and nonferrous materials, plastics and other nonmetallics, an indispensable guide.

A special schedule of rates for copies in quantities has been established. Orders are filled postpaid.

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1	25c	$ 0.25
10	20c	2.00
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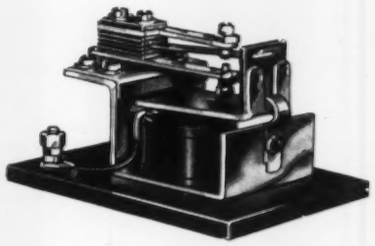
MACHINE DESIGN

Penton Building Cleveland, Ohio

contacts are mounted on rigid brass arms, allowing extremely close adjustments. The built-in armature guard precludes all possibility of the armature's becoming jarred out of position, and yet allows "full floating" action, necessary for high sensitivity. The

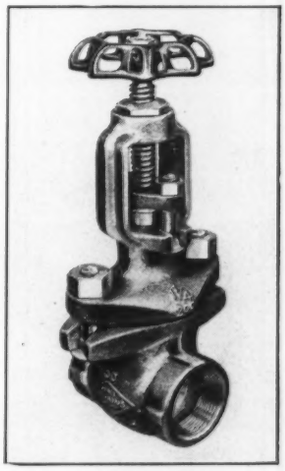


Built-in armature guard on the type 500 *relay prevents the armature from becoming jarred out of position, yet allows floating action*

contact system is single pole, double throw, with pure silver contacts, rated at 1.5 amperes at 115 volts. Coils are obtainable in resistances up to 3000 ohms. The complete unit, mounted on a 3/16-inch Bakelite base, measures only 3¼ x 2¼ x 2 inches. The coil core, armature and frame are made from pure iron. There are binding posts for coil terminals. If desired, the relay is obtainable with coils having a resistance less than 1000 ohms.

Stainless Valves in Seven Styles

CORROSION-RESISTING stainless steel valves have just been placed on the market by Jenkins Bros., Bridgeport, Conn. Regular lines available are made of Cooper 18-8 S and Cooper 18-8 SMO, each having a carbon content limited to a maximum of .10 per cent. These two alloys, it is said, will take care



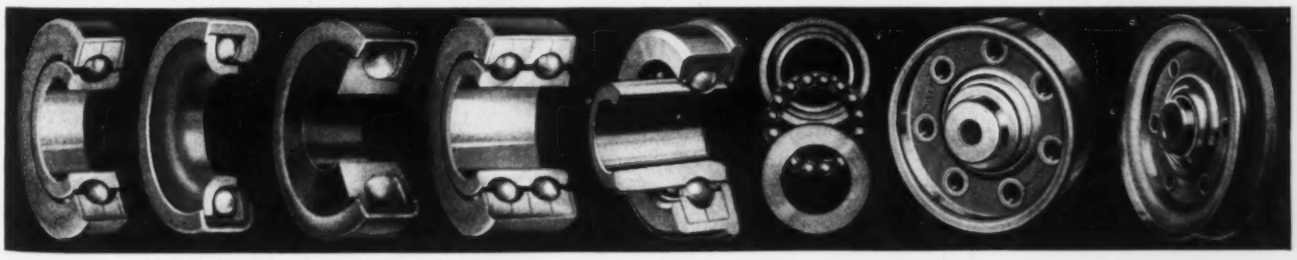
Illustrated is a corrosion-resisting stainless steel gate valve, one in a new line of 18-8 *composition, with low carbon content*

of almost 90 per cent of corrosion-resisting requirements. The new Jenkins valves are available in seven different styles: Solid wedge or double disk gate valves, illustrated union bonnet or bolted bonnet regrinding globe or angle valves and bolted bonnet "Y" valve. All styles come either screwed or flanged, in sizes from ½ to 3-inch. In cases where neither of these alloy analyses

. . . looking for a ball bearing?

Any bearing that you see here is a "stock" item obtainable from any one of our 75 stocking distributors located throughout the country. These bearings are just a few samples of the 500 different types and sizes of Nice bearings listed in our general catalog—suitable for shaft diameters ranging from 1/8" to 3 1/2". For complete dimensions and list prices of all these Nice Ball Bearings and for the address of your nearest distributor, send for your free copy of our General Catalog 52.

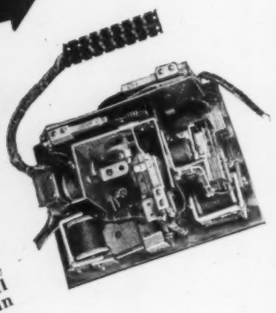
BOSTON GEAR WORKS, INC., NORTH QUINCY, MASS.



Everything in RELAYS

. . . from this

to THIS!



Two products from the same plant . . . one a simple contact switch . . . the other an intricate assembly of many electrical control units, with 5 different types of relays, stepping relays, shutter control relays, time delay relays, interlocking relays, a 12-point multi-connector plug, and a dozen or more metal stampings, cams and special forms. Every part is made in Guardian's own factory . . . designed by Guardian Engineers . . . and assembled compactly in a space scarcely half the area of this page. Here is a convincing example of the astonishing VARIETY of the work we do.

Whether YOUR electrical control problem is simple or complex . . . you'll find the correct solution in Guardian Engineering Service and Guardian-built equipment. WRITE US today. Get our Big New Relay Catalog D. Or ask us to make specific recommendations to fit your special requirements.

When ordering direct, specify current, voltage, amperage, contact combination and load through contacts.

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Remember, if it's a job for a rotary pump, you'll find the pump at Viking.

The famous Viking principle consists of only 2 moving parts —your guarantee of lasting performance free from expensive repairs.

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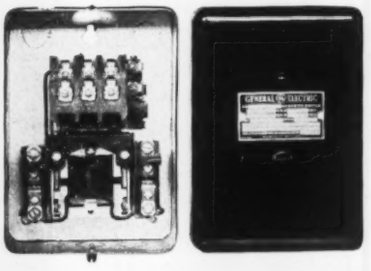
can be recommended, valves of other alloys will be considered.

Switch for Motor Starting Announced

PRIMARILY intended to meet the requirements of machinery manufacturers for smaller control equipment for built-in mounting, a new alternating current magnetic switch for full-voltage motor starting has been developed by General Electric Co., Schenectady, N. Y. Basically, the switch consists of a line contactor with interlock to provide undervoltage protection, and two isothermic temperature overload relays to protect the motor against overheating. These elements are mounted in a general-purpose sheet steel enclosing case. The open type switch, illustrated, is furnished with a rigid mounting plate to permit easy mounting on either an insulating or a conducting panel. In addition to its small physical dimensions, principal features claimed for the switch are conservative electrical design, long mechanical life, low maintenance costs.



New magnetic switch for motor starting is designed to meet requirements for smaller control equipment for built-in mounting

Porcelain Enamel Finish Developed

FOR space heater application, a new porcelain enamel finish known as "Silverflake" has been developed by the Chicago Vitreous Enamel Product Co., Cicero, Ill. This finish is merely a "ground coat" over-sprayed with a "silverflake" liquid. Hence a single labor application and a single firing are all that are required to provide a surface. This new finish has a dark color background which provides an excellent contrast for the "silverflakes." Being inorganic porcelain enamel, "Silverflake" is immune to discoloration, heat corrosion, absorption. It is easy to clean and can be applied equally well to either cast iron or sheet steel.

Furnace Pressure Controller

FOR controlling any pressure in the range from —5.0 inches of water to 5.0 inches of water, the Air-O-Line furnace pressure controller has been announced by The Brown Instrument Co., Philadelphia. The controller is essentially a sensitive, inverted-bell type draft indicator combined with the Brown Air-O-Line control unit. Automatic reset and fully adjustable

Machines, Jobs, and Advertising*

MACHINES have been in the limelight pretty much recently and there has been a good deal of misleading talk about them. One fallacious notion about machines is that they cut down the amount of employment—that greater use of machines in industry means a smaller number of jobs.

It is important that we know the truth about this, for without question machines have deeply affected all industry and its individual wage earners. The facts show that besides making life easier for workingmen, machines also create new opportunities for employment and actually increase the total number of jobs. In this process, advertising is a very important factor.

About the time of the American Civil War our industries began to change from neighborhood shops with hand labor to the modern factory system, equipped with machines run by power. From the very beginning of this movement there were always some people raising the cry that machines put men out of work. But that has not happened, for the simple reason that machine-made goods were sold at lower prices, more people bought them, and more men were employed to make them.

Not long ago all window glass was manufactured through the lung power of human glass blowers. Now it is all made by the use of huge glass-making machines. The cost is much less and so much glass is used that many more men are employed in the industry than formerly. At the last census, 98,000 persons were employed in glass factories.

Shortly after the Civil War the amount of mechanical power used to operate machines in American industries was only 1-1/10 horse power for every wage earner. Sixty years later there was 4-9/10 horse power per wage earner. As a result the amount of work turned out by each man rose so rapidly during this period that the value added by manufacture increased from $658 per wage earner to $3,600. In other words, the mechanical power used in industry increased more than four-fold per worker and the output per worker increased more than five-fold.

And in the meantime, what happened to employment? In the same period the population of our country increased 3-1/10 times and the number of persons gainfully occupied increased 3-9/10 times. As industry substituted machines and power for hand labor, the productivity of each worker increased and the number of jobs increased faster than the population. During this same period the annual earnings per worker were multiplied by nearly 4½.

When we think of this tremendous progress it is well to remember that the greatly enlarged output of industry does not automatically find a market. One of the most important factors in distributing the ever-increasing volume of goods is the use of advertising, without which this mass distribution would be impossible. In a way, advertising is really a key to our industrial progress. Many industries owe their growth directly to the power of advertising.

The machine age means more things for more people and advertising is its indispensable tool.

*PREPARED BY THE BUREAU OF RESEARCH AND EDUCATION, ADVERTISING FEDERATION OF AMERICA

Advertisement

Compare Snap-Lock!

WITH THE BEST LIMIT SWITCH YOU'VE EVER SEEN!

- Two double-break circuits, either normally open or closed.
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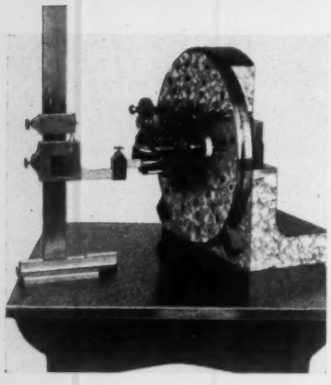

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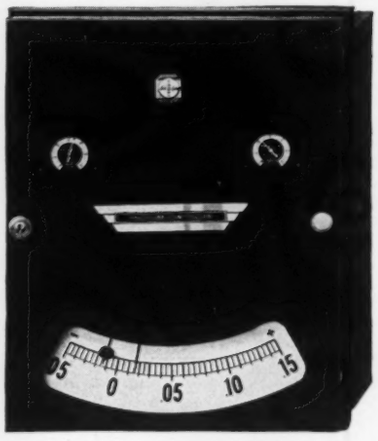
throttling range prevents the furnace pressure from lining out at some point other than the control point and eliminates over-correcting and cycling. Almost instantaneous in operation, the instrument's pointer will move 10 per cent of the total range in one second,

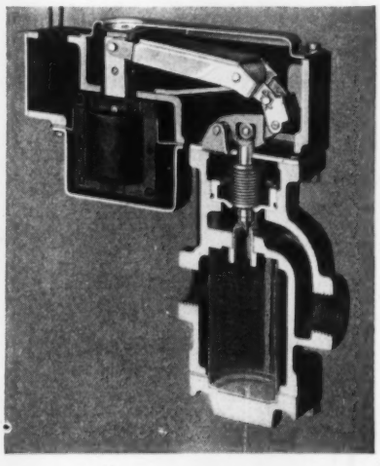


An inverted-bell type draft indicator has been combined with a control unit to make this furnace pressure controller

and 100 per cent of the total range in three seconds. The controller is adaptable to installation on all types of furnaces, stills, kilns, ovens, and other equipment.

Unusual Design in Solenoid Valve

A DEPARTURE from conventional design of solenoid valves is found in a new electrically operated valve announced by McDonnell & Miller, Wrigley building, Chicago. This design was developed to insure tight closure against water or fluid pressure up to 150 pounds. To accomplish this, the weight of the solenoid armature is not depended on to hold the valve closed. Instead, it is tightly seated by a spring-loaded leverage system as illustrated. The long lever connected to the armature of the solenoid, gives the solenoid sufficient mechanical advantage for positive opening of the valve.



Tight closure against water or fluid pressure up to 150 pounds is accomplished in new solenoid valve by spring-loaded leverage system

Lifting Curtain on '39 Cars

(*Concluded from Page* 25)

ratio of the gear is 21.6-1 as compared to 18.2-1 for the 1938 model.

Chevrolet has dropped the previous Dubonnet front suspension in favor of the parallel link type which is practically universal on American cars. The chief difference is that the axes of the link anchorages on the frame are parallel, as seen in *Fig.* 9. The entire suspension and the front cross member which is bolted to the side rails become a single unit.

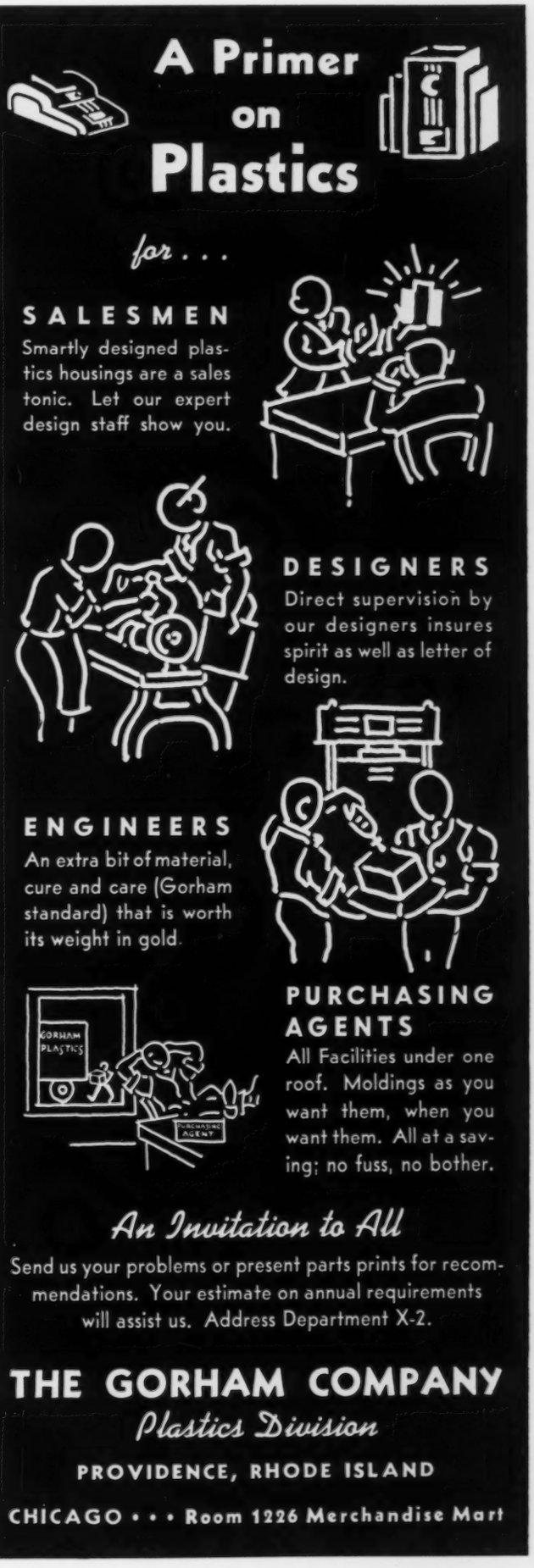
Adequate ventilation and warmth have been provided. Nash's "weather eye" has been improved by the addition of a temperature control knob outside the unit and an automatic thermostat within. A rain and sleet shedder has been added to the inclined air filter. A capacity of 800 cubic feet of outside air per minute is obtainable. The Studebaker system, *Fig.* 10, consists of a sealed metal housing beneath the floor at the left front seat. It contains a filter, a horizontal hot water core and a fan and motor below it. Air is sucked from the outside through a passageway located above the running board. The heated and cleaned air is discharged through an aperture under the front seat and distributed to the front and rear compartments. Capacity is in excess of 230 cubic feet per minute and an be maintained when it is zero outside.

Smoothness of Operation is Considered

For smoother running Cadillac has relocated the fuel pump eccentric on the camshaft and added a counterweight to the camshaft sprocket. Chevrolet tappets are cast solid and subsequently drilled out and the push rods seat in them with a spherical surface. An increasing number of cars provide a pressure vent in the radiator cap. For instance, the Cadillacs raise the boiling temperature to 229 degrees at sea level by holding the vent closed until the pressure of 5½ pounds per square inch has been reached. The automatic choke is being built into the carburetor as a unit instead of a separate assembly. Cadillac has adopted the 10-millimeter spark plug.

The Oldsmobile clutch fingers with flattened, large bearing-area tips ride directly on the graphite throwout ring, affording simplification and improved clutch ventilation. All Ford products and Overland use hydraulic brakes. Hudson's "Auto-Poise" for self-righting consists of a front sway eliminator bar ahead of the front axle with the ends connected to the wheel spindles by inclined connecting links, swinging outwardly to the spindle anchorages.

As excellent as the new models seemed a year ago, it is apparent that the 1939 models emerge with renewed beauty and incorporation of many worthwhile improvements. Mindful of the economic situation, the automobile manufacturers have accomplished much toward business revival through price reductions.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Topics

(*Concluded from Page* 18)

meeting of the American Welding Society in Detroit, during the National Metal Exposition. Copper is an excellent conductor of electricity, but is soft; the copper-beryllium-chromium alloy, called Trodaloy, has lower electric conductivity, but is much harder, tougher, usable at higher temperatures. And its conductivity is still higher than that required. Another grade of Trodaloy, 970 parts copper, 26 parts cobalt, four parts beryllium, has even greater hardness, temperature and tensile strength values, but a lower electric conductivity. Trodaloy electrodes are said to outlast copper electrodes by a wide margin. The metal may also be used for switch blades, cams, spring fingers, etc., where copper will not serve, but electrical conductivity is essential. Beryllium, a third lighter than aluminum is obtained from beryl ore, found in widely scattered parts of the world. Largest deposits in this country are in Black Hills of South Dakota. Biggest single beryl crystal ever reported was found several years ago in Brazil. Its dimensions were approximately 17 feet by 40 inches, and it weighed about three tons. Melting point of beryllium is higher than 2300 degrees Fahrenheit, its modulus of elasticity, 27 million pounds to the square inch.

♦

Zinc die casting alloys are finding an increasingly important market in the business machine field, embracing coin-operated vending devices, office and store equipment, and gaming apparatus. Wurlitzer's new Simplex phonograph, coin-operated, incorporates 68 die castings of zinc alloys, made in 36 different dies. The peanut vendor of Stewart & McGuire is assembled from 22 die castings, virtually the whole unit. A new paper fastener being brought out by Progressive Mechanical Corp. is all die cast except for the steel wheels which do the crimping. Seven more die cast parts have been added to the Woodstock typewriter, the main frame of which has been made of zinc for years. The handsome new rotor machine by Ditto is 60 per cent by weight zinc die castings—32 parts.

♦

The growing use of magnesium in building airplanes was explained by W. G. Harvey, American Magnesium Co., before the recent National Aircraft Production meeting in Los Angeles. In 1925 only 10,000 pounds of magnesium alloy were manufactured. By last year production had increased to 800,000 pounds of castings. About 70 per cent of this amount went into aircraft and engines. The castings contained 85 per cent or more of magnesium, with aluminum or combination of aluminum or zinc.

Meetings and Expositions

Nov. 5—

Vacuum Cleaner Manufacturers association. Annual meeting to be held in Cleveland. C. G. Frantz, 1070 East 152nd street, Cleveland, is secretary.

Nov. 9-11—

American Institute of Chemical Engineers. Annual meeting to be held at Benjamin Franklin hotel, Philadelphia. Stephen L. Tyler, 29 West Thirty-ninth street, New York, is secretary.

Nov. 11-17—

Fifth Annual Motor Truck Show. To be held at New York Port of Authority building, New York. Charles F. Roth, International Exposition Co., Grand Central palace, New York, is manager.

Nov. 11-19—

National Automobile Show. To be held at Grand Central palace, New York, under the auspices of Automobile Manufacturers association, 366 Madison avenue, New York.

Nov. 14-16—

Society of Automotive Engineers. Transportation engineering meeting to be held at Hotel New Yorker, New York city. John A. C. Warner, 29 West Thirty-ninth street, New York, is secretary.

Nov. 15-18—

National Association Practical Refrigerating Engigeers. Annual meeting and exhibit to be held in New Orleans. Emerson Brandt, 228 North La Salle street, Chicago, is secretary.

Nov. 16-17—

Porcelain Enamel Institute. Eighth annual meeting and sales conference to be held at Hotel Statler, Cleveland. Charles S. Pearce, 612 North Michigan avenue, Chicago, is managing director.

Nov. 17—

Counter Freezer association. Annual meeting to be held in New York. C. Seymour Clark, 35 East Wacker drive, Chicago, is secretary.

Dec. 2-3—

National Standard Parts association. Annual meeting to be held in Chicago. E. P. Chalfant, 1420 United Artists building, Detroit, is executive vice president.

Dec. 5-9—

American Society of Mechanical Engineers. Annual meeting, technical and business sessions to be held in

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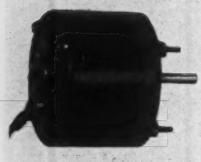
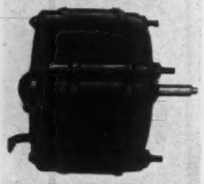


MODEL M35



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New York. C. E. Davies, 29 West Thirty-ninth street, New York, is secretary.

Dec. 5-10—

National Exposition of Power and Mechanical Engineering. Held at Grand Central palace, New York. Charles F. Roth, International Exposition Co., Grand Central palace, New York, is manager.

Dec. 6-8—

American Society of Refrigerating Engineers. Annual meeting to be held in New York. David L. Fiske, 37 West Thirty-ninth street, New York, is secretary.

Dec. 12-14—

National Warm Air Heating & Air Conditioning association. Annual meeting to be held in Cincinnati. Allen W. Williams, 50 West Broad street, Columbus, is secretary.

Dec. 12-15—

National Association of Coin-Operated Machine Manufacturers. Annual meeting and exhibit to be held at Stevens Hotel, Chicago. Clinton S. Darling, 120 South LaSalle street, Chicago, is secretary.

Stainless Steel Holds Sway at Dairy Show

(*Concluded from Page* 38)

possibility of dirty recesses. Where other fastening methods are not feasible, hollow-head screws have been found valuable in that they also minimize dirt accumulation. Motors and other moving parts were formerly left uncovered (since in many cases they were considered far enough removed from the actual products being processed), but now are enclosed as a further sanitary measure.

Mechanically, several practices are noticeable in modern dairy machinery. As in many other types of equipment, belt drives are predominantly of the V-belt type. Gear motors, too, are much in evidence. Variable speed mechanisms are popular, and are one of the principal selling points.

Dairy machinery in general offers one of the most fertile fields of study for designers, even those not directly associated with the industry. On the one hand, designers of dairy equipment face the challenge of much more potential mechanization. A great many jobs, some done by hand or in separate steps, will need to be simplified, speeded up, smoothed out. Conversely, designers of other machines can learn much by observing the variety and ingenuity of mechanical equipment already operating in the dairy field.

Understanding Rubber Increases Engineering Uses

(*Concluded from Page* 34)

sure can be obtained on the bonded areas during vulcanization. Inasmuch as vulcanization takes place anywhere from 270 to 420 degrees Fahr., the rubber—on cooling after being removed from the mold—may shrink as much as 3/16 to ¼-inch per foot. The split shell permits this shrinkage to adjust itself. Furthermore, the split shell permits the rubber to be placed under radial compression when the bushing is assembled.

It has been definitely proved that such compression very materially adds to the fatigue resistance of the rubber and reduces the amount of creep which takes place in the structure. Such initial radial compression has the added advantage of reducing the deflection of the inside metal member of the bushing in the rubber when placed under radial load. Such bushings can therefore be designed to make the rubber its own bearing with very little out-of-center movement of the inside metal member, thereby affording a complete rubber isolation between the inner and outer members of a rubber torsion spring.

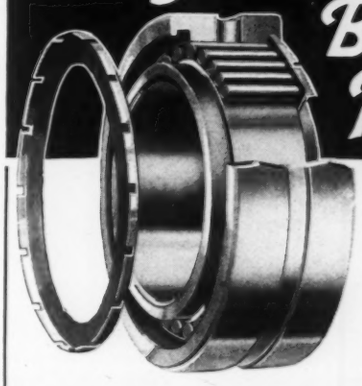
Where torsion bushings are to be used as springs and the rubber is to form its own bearing without the aid of auxiliary bearings, it is important that the radial deflection of the central steel tube in the rubber be known. As the central shaft moves downward in the rubber, all that the rubber can do is to flow around the shaft, like fluid displacement.

Much Work Remains To Be Done

The author has presented some of the characteristics of rubber in which engineers may be interested from a design standpoint, without going into detail on every phase which might affect design. There remains a vast amount of data which should still be collected, especially to establish accuracy on some points that seem to be in doubt. In order to obtain such data accurately it will be necessary that the tests be conducted in rooms where the temperature, and possibly the humidity, are closely controlled. The accuracy of tests to determine the moduli of elasticity and the creep of shear and torsion springs is very decidedly affected by the temperature because of the joule effect.

The previous history of a spring, as to the number of loadings to which it has been subjected, must always be considered in analyzing results. True measurements of hardness are especially difficult because of the human element which still enters into such measurements. As time goes on, rubber men will undoubtedly standardize on basic recipes for springs, accurately determine their fundamental characteristics and together publish them.

Confronted with a Bearing Problem?



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